

SCIENTIFIC AMERICAN

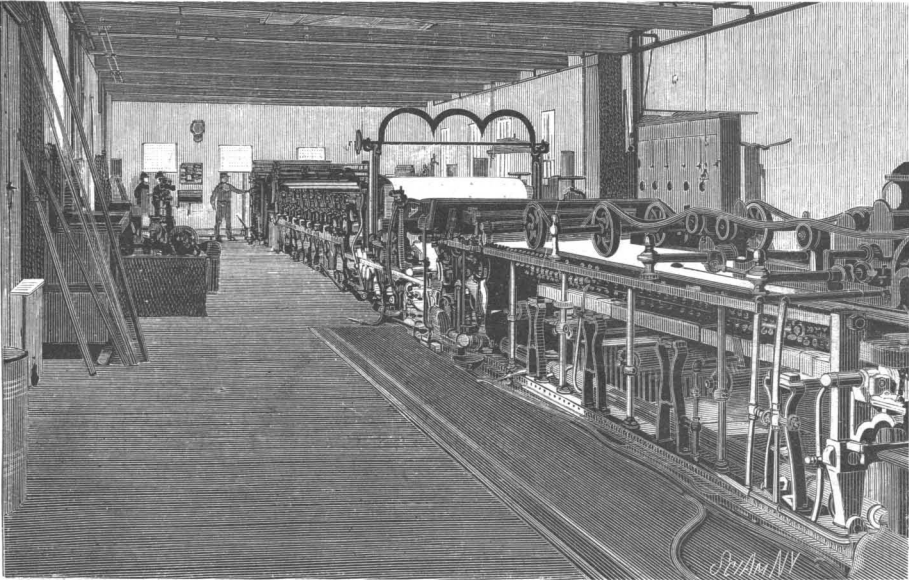
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1899, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

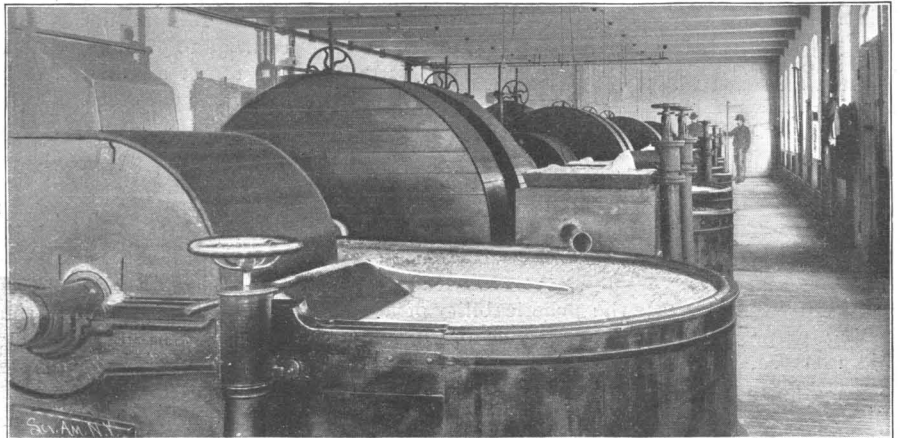
Vol. LXXX.—No. 23.
ESTABLISHED 1845.

NEW YORK, JUNE 10, 1899.

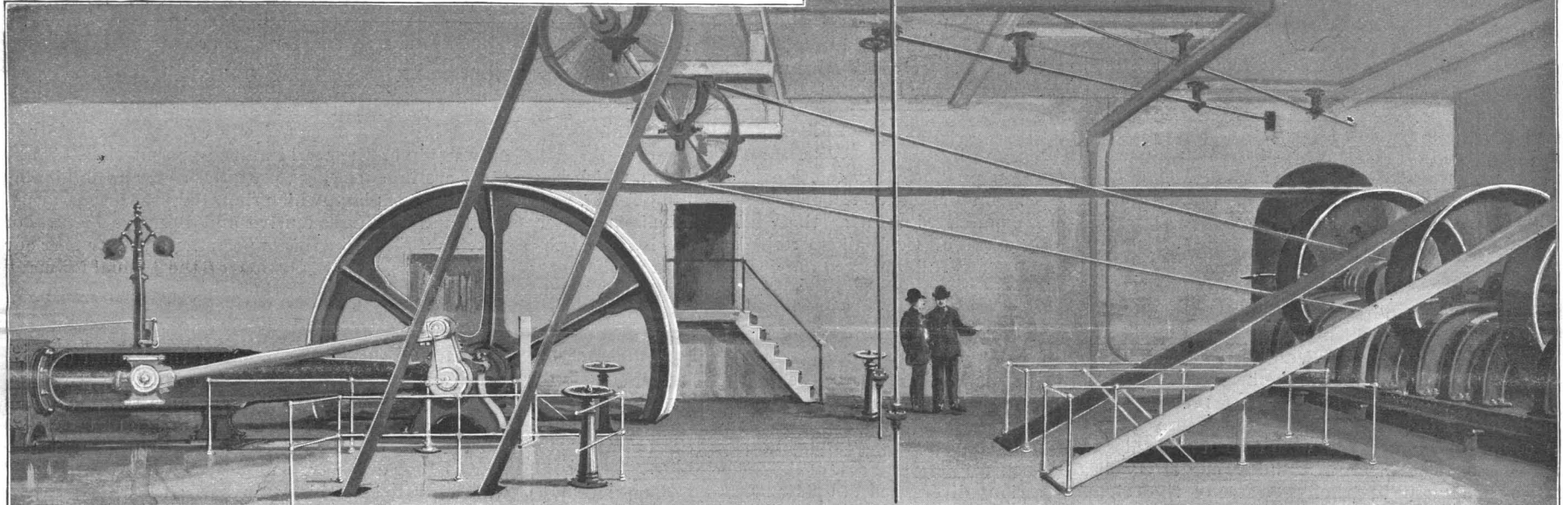
\$3.00 A YEAR.
WEEKLY.



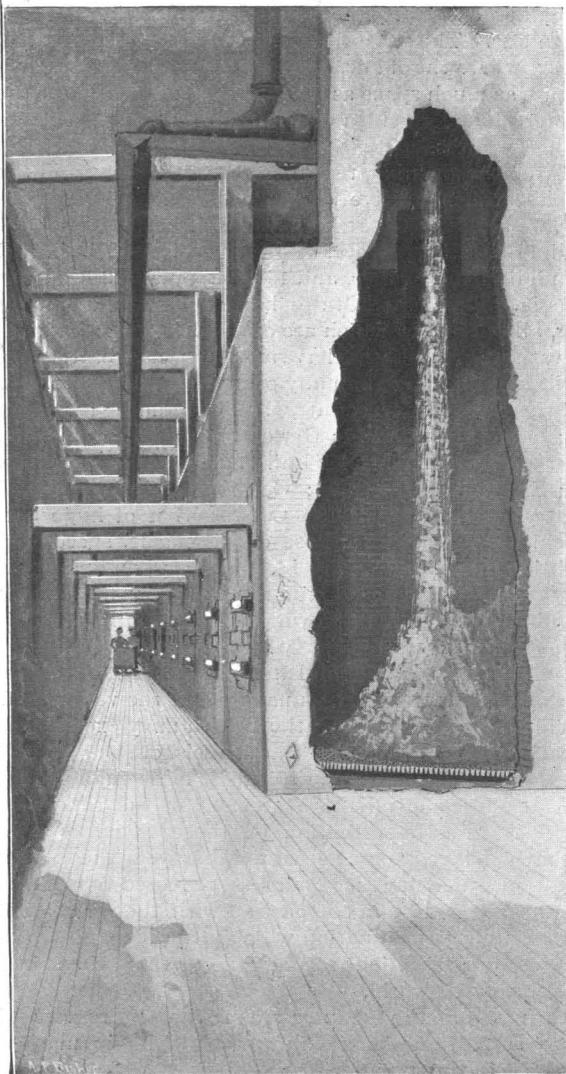
1.—Paper Machine.



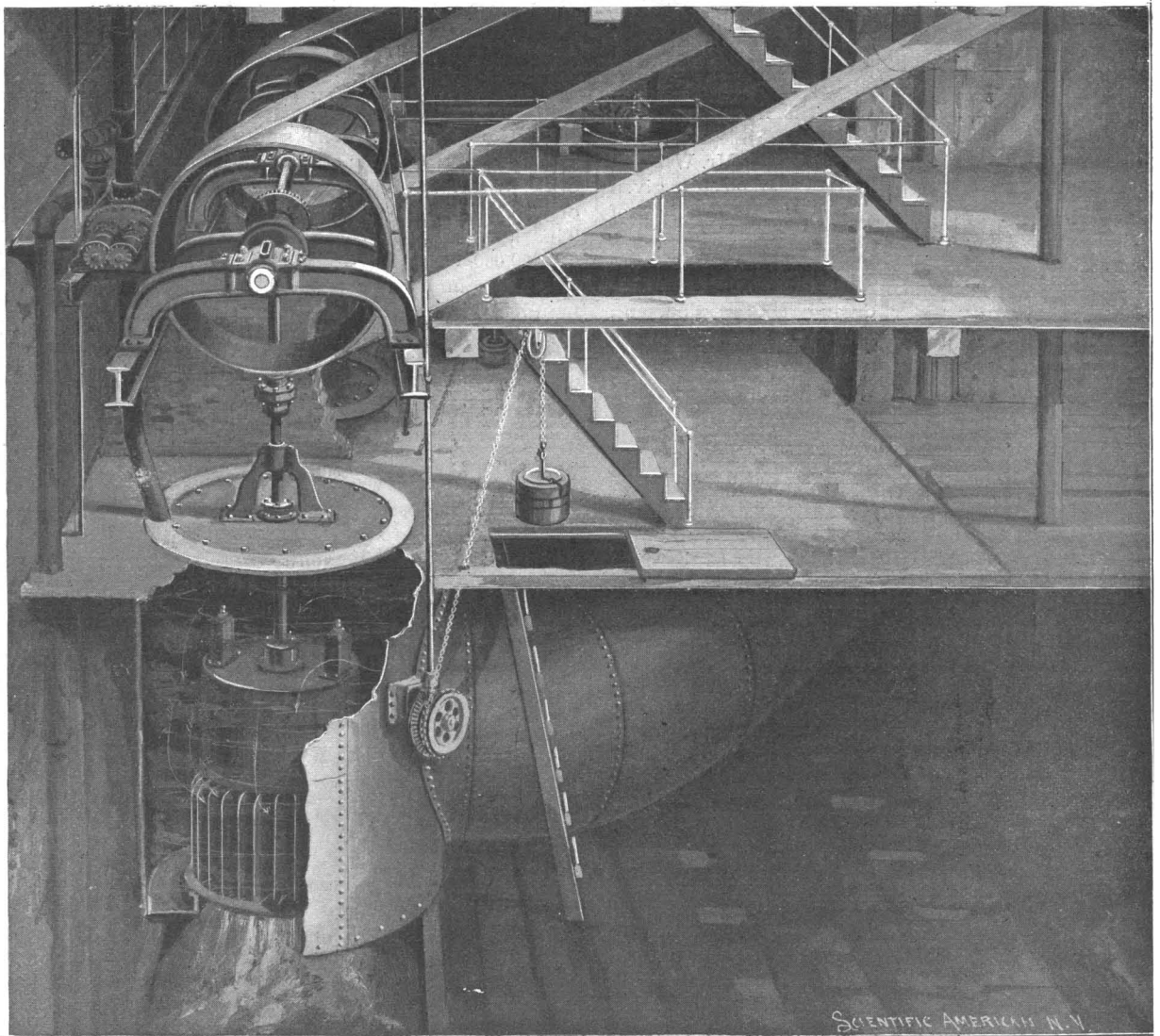
2.—Rag Engine Room—Washing and Beating the Rags.



300 H. P. Corliss Engine.



3.—Draining Room.



Two 150 H. P. Turbines.

MANUFACTURE OF LINEN LEDGER PAPER—PLANT OF THE BYRON WESTON COMPANY.—[See page 378.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.
PUBLISHED WEEKLY AT
No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico, \$3.00
One copy, one year, to any foreign country, postage prepaid, £0 14s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....\$3.00 a year.
Scientific American Supplement (Established 1876)..... 5.00 ..
Scientific American Building Edition (Established 1885)..... 2.50 ..
Scientific American Export Edition (Established 1873)..... 3.00 ..

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, JUNE 10, 1899.

LIQUID AIR "SURPLUSAGE."

Now comes Mr. H. Gaylord Wilshire, editor and publisher of the *The Philistine*, a magazine "devoted to the demolition of preconceived ideas," who tells the Southern California Academy of Sciences that he can scientifically demonstrate the practicability of accomplishing perpetual motion by means of liquid air. Briefly stated, the demonstration is as follows: A given weight of liquid air will theoretically liquefy an equal weight of air without the aid of cooling water. If the resistance to compression of the air be reduced by passing it through cooling water, the liquid air will liquefy its own weight of air, plus an additional weight due to the cooling water. This is a "surplusage," and hence perpetual motion!

In detecting a fallacy it is sometimes as well, even at the risk of reiteration, to get down to first principles. If a given volume of air at atmospheric pressure and temperature be compressed to a smaller volume, it will have a pressure which is the result of its decrease in volume and the increase in its temperature due to its compression. The pressure due to reduction of volume is permanent at a given temperature, but the pressure due to the rise of temperature is transient, and will disappear as the heat of the compressed air radiates into the surrounding atmosphere. That part, then, of the energy expended in the compressor which appears as heat in the compressed air is a positive loss in all engines which make use of either compressed or liquid air as a motive power.

When air is compressed for power purposes, it is necessary to cool it during compression by passing it in a coil through water which is at atmospheric temperature. If it were not so cooled, and were delivered to the storage cylinders carrying all the heat of compression, it would suffer a subsequent fall of pressure which would amount to the same thing as if it were cooled at the compressor, and there would be a great loss of effect due to the heat so withdrawn. Every heat unit carried off in the cooling water of the original compression is a loss that must be charged against the compressed air or the liquid air, as the case may be, in every subsequent operation in which it plays a part; and when liquid air enters the lists in competition with steam, electricity, hydraulic or any other form of power, it starts with this heavy handicap against it.

In the lecture to which we have referred, Mr. Wilshire argues that in a theoretically perfect engine a given weight of liquid air would produce the same weight of compressed air, if both the liquid air cylinder and the compression cylinder were in free contact with the atmosphere. He then supposes the compressed air to be cooled with water during compression, and argues that such cooling would enable the liquid air to compress an additional volume of air, which he called a "surplusage." The fallacy of the argument lies in the fact that the liquid air itself has already been robbed of its own heat of compression, and the application of cooling water to the air which it is now compressing would merely enable it theoretically to produce by compression and expansion in a frictionless engine a weight of air just equal to itself.

There is no "surplusage" except in the exuberance of the lecturer's own imagination, and the cumbersome wit with which he rails at what he is pleased to call the "scientific Gradgrinds," who, be it said, have very effectually pricked the liquid air bubble. Mr. Wilshire's lecture, which is quite unique in its way, will be reviewed in the next issue of the *SCIENTIFIC AMERICAN* by President Morton, whose recent exposure of the liquid air fallacies has already attracted world-wide attention.

THE REASON WHY.

American master mechanics were the first to appreciate and prove the advantages of building express engines in which the center of the boiler is placed well above the driving wheels; and it is certainly late in the day for an American journal of the pretensions of Engineering News to be in ignorance of the excellent and obvious reasons for this modern practice. In a recent issue our esteemed contemporary, speaking of the new English express engines (illustrations of which appear in

our SUPPLEMENT of the 3d inst.), informs its readers that these locomotives "are of a most peculiar appearance, as *in order to clear the crank axles the boiler is pitched so high* (the italics are ours) that its top is level with the roof of the cab, and this necessitates a little, dumpy smokestack which seems to have no relation to the boiler." As a matter of fact, the cranks have nothing whatever to do with the height of the boiler, there being no less than 15 inches clearance between the bottom of the boiler and the connecting rod ends at the highest point of their revolution. Engineering News evidently is not aware of or does not appreciate the fact that it was Mr. Buchanan, late master mechanic of the New York Central Railroad, who first had the courage to place the center of the boiler two feet above the top of a pair of 7-foot driving wheels, in order to allow the use of a boiler barrel that should be larger in diameter than the space between opposite wheels. As tried in No. 999, whose boiler centerline was a fraction less than 9 feet above the rails, the experiment was eminently successful; for not only was a large tube heating surface secured, but the high center of gravity was found to give an engine that was less destructive to track and roadbed. Inside cylinders may be answerable for many troubles, but a high center of gravity is certainly not one of them, any more than is "a little, dumpy smokestack." This last felicitously named deformity we must further inform our contemporary is due to the fact that the shallow loading-gage on English railways will not allow the smokestack to take on more æsthetic proportions. The same defect in appearance (if defect it be) is noticeable in the big Schenectady engines built some six or seven years ago for the New Haven road, which, we believe, is hampered by some bridges and tunnels that are lower than is common in American practice.

The late A. M. Wellington himself was never friendly disposed to inside cylinders, and for the best of mechanical reasons; but to hear them thus maligned is enough surely to disturb the shades of that gifted and ever-to-be-lamented editor.

REPORT OF THE NICARAGUA CANAL COMMISSION.

The present Nicaragua Canal Commission, which was appointed under an Act of Congress of June 4, 1897, and is popularly known as the Walker commission, after Admiral J. G. Walker, retired, U. S. N., has submitted its full report to the President. A preliminary hearing was given last summer with a view to putting Congress in possession of sufficient data to enable it to legislate on the question during its late session; and while in the nature of things it was impossible, in the then incomplete state of the data, for the commission to give accurate information, it was evident that a serious disagreement existed among the members of the commission on certain fundamental questions relating to the feasibility and cost of the undertaking! The most serious divergence of opinion was on the question of cost, the ranking member and most distinguished engineer of the commission putting the possible cost at about \$150,000,000; the Admiral placing it at about \$125,000,000, and Prof. Haupt declaring that it could be done within \$90,000,000.

In the report just presented, Admiral Walker and Prof. Haupt, who at the preliminary hearing were both ardently in favor of the immediate construction of the Nicaragua Canal, have compromised on a sum of \$118,113,790 as representing the probable total cost. This is a jump on the part of the professor of over \$28,000,000, or an increase of over 30 per cent on his original estimate of \$90,000,000. As the latter gentleman has already said in committee, "the question of cost does not carry very much weight in my mind, even if it were \$200,000,000," the astounding difference in his two estimates is easily explained. Col. Hains, who has always shown a conservatism becoming the stupendous nature of the undertaking, estimates the final cost at \$134,818,308.

The commission was required to examine all routes heretofore proposed that had any merit, and any new routes that appeared to be feasible, so as to be in the position to present an exhaustive report on the entire region of canal possibilities. After mature deliberation the commission has recommended the Childs route from Brito on the Pacific to Lake Nicaragua, and the Lull route from the lake to Greytown on the Atlantic. The Childs survey was made as far back as 1852 by a distinguished canal and railway engineer of that name, and the Lull survey was carried through in 1873 by Commander Lull, U. S. A., who was sent to the isthmus by the government to re-survey the Childs route. All the members of the Walker commission, although at variance as to cost, are agreed in rejecting the unprecedented and perilous features of the Menocal surveys of 1887 to 1890, and returning to the original plans. As modified, these plans call for a single dam with regulating works at each end of the summit level. On the Pacific side the route follows the left bank of the Rio Grande, crosses the Western Divide to the valley of the Lajas, which river is followed to its entrance to Lake Nicaragua. From the lake the route lies in the bed of the San Juan River to near Boca San Carlos,

where it leaves the river and follows its left bank in excavation to the San Juanillo, from which point it is cut across the alluvial land to Greytown. For a complete map and illustrations of the Nicaragua country, the reader is referred to articles published in the *SCIENTIFIC AMERICAN* of February 18, 1899, and the SUPPLEMENT of April 1, 1899. It is stated that the survey, which has been carried out by a strong force of about one hundred engineers, has brought to light more favorable physical conditions than were anticipated, particularly in the upper San Juan River, where the rock excavation is less than was indicated by the preliminary surveys.

No definite action can be taken by Congress at this time, as it must now await the report of a new commission, authorized at the close of the last Congress, which is empowered to investigate not only the Nicaragua but the Panama and any other possible route, and report as to which is the most feasible to construct and operate. It will probably be a couple of years before the final report of this commission can be made the subject of legislation.

BRASSEY'S NAVAL ANNUAL.

The stirring events of our late war have lent a special interest to the annual publications which deal with the development and statistics of the world's navies, and the recently issued volume of Brassey's Naval Annual, the thirteenth of its kind to appear, devotes two lengthy chapters to the Spanish-American war and the United States Navy. The present volume is somewhat larger than its predecessors, the rapid growth of the various navies causing the tables and diagrams of the ships steadily to increase in volume. There are thirteen very good plates from wash drawings of notable battleships and cruisers interspersed through the reading matter, the "Iowa" being chosen from our own navy for reproduction. There are also nine charts and diagrams, seven of which are explanatory of the naval operations of the war. About one hundred pages are given up to tabular lists of all the warships of the world, and these are followed by ninety plates containing plans of practically every important type of warship in the world at the present time. These plans are line drawings, prepared as far as obtainable from working plans, which show only the armor, armament and leading offensive and defensive features of the ships. We take this opportunity of expressing our indebtedness to this portion of the Annual for many of the small diagrams which have accompanied our articles on the navies of the world.

While upon this subject we would suggest that as the plates in the later editions of the Annual (to save space) are being produced in two sizes, full page and half page, it would be better to reduce the older ships to half page size and reserve the full page plates for the later and more important vessels. Thus among the plates of our own navy we find that while the "Texas," which is rated in this Annual as a third class battleship, is allowed a whole page with five drawings, our latest first-class battleships of the "Alabama" and the "Maine" classes are confined to two drawings of half page size. The same thing is noticeable in the British navy, where the old armored cruiser "Imperieuse" occupies as much space as the two cuts representing the powerful modern ships of the "Cressy" and "Formidable" classes.

From the opening review by Lord Brassey and the tables of comparative strength given in a later chapter, we find that Great Britain has 41 battleships built and 16 building, a total of 57, as against 32 built and 4 building for France, and 15 built and 6 building for Russia. The United States have 5 built and 8 building, all but one of which are of the first class; and it is a gratifying fact that we have more first-class battleships built and building than any other power but England. Of these the latter country has 34 building; France, 11; Russia, 10; Italy, 7; Germany, 9; and Japan 6. Of cruisers England has 137 built and building; France, 52; Russia, 28; Italy, 21; Germany, 24; the United States, 20; and Japan 18. Construction of huge battleships and cruisers whose displacement, speed, and fighting qualities steadily increase, goes on apace. If any one is disposed to doubt the necessity for making regular additions to our own navy, we would draw his attention to a statement which has recently issued from the office of Naval Intelligence, Washington, to the effect that the total tonnage of all the vessels now building or authorized for the British navy exceeds the total tonnage of all the war vessels of the United States navy, built and building, by more than 100,000 tons. We commend this statement of the Navy Department to the attention of those Senators who recently delayed for at least another year the modest addition which our last Congress proposed to make to the navy—modest in comparison with the wealth and responsibilities of a nation which is rapidly moving to the leading position among the great commercial nations of the world.

In reading the chapter upon the "Progress of Foreign Navies," one is impressed with the marked decrease in the number of unprotected cruisers which are being built, all the new tonnage being put into

ships of the armored class, either battleships or cruisers. Japan indeed is the only nation that is building protected cruisers on any considerable scale; a fact which may be largely explained by the excellent work which was accomplished by this type of vessel in her war with China. The rapid growth of the Japanese navy is one of the most remarkable naval events of the last decade of the century. The new shipbuilding programme provides for four battleships, six first-class and three second-class cruisers together with several smaller vessels, and all of the ships are being pushed to completion with as little delay as possible. The progress of the United States navy is described under a separate chapter written by Lieut.-Commander W. H. Beehler, of the navy, which will naturally be of extreme interest to all Americans. Lieutenant Beehler traces the growth of the navy from the time of the Civil War to the present day. The administration is outlined at considerable length; then follows a description of the personnel, with tables giving the rank and total numbers of the various officers with their rates of pay, whether at sea or shore duty, or on leave or waiting orders. The same is done with regard to the chief petty officers and the various grades of seamen and other subordinates.

The chapter explains in detail the means by which apprentices enter the navy and the course of training which they subsequently undergo, and this part of the article renders in condensed form a considerable amount of information which is not easily accessible to the public. Considerable attention is paid to the navy yards and stations and the private shipbuilding yards, while the last few pages of the article are devoted to description of the latest ships that are now being constructed for the navy.

The succeeding chapter, by G. S. Clarke, is devoted to the Spanish-American war. It contains excellent plates of Manila Bay, the island of Cuba, Santiago Harbor, and of the coast to the westward of Santiago, along which the running fight between the Spanish and American ships took place. There are also plates showing the number and location of the hits made on Admiral Cervera's fleet, and a few small diagrams illustrating the method of disposing our warships during the blockade of Santiago. The whole chapter of over fifty pages forms one of the best compendiums of the Spanish-American war that has yet appeared, and the lessons of the war as drawn by the author are conservative and just and in the main agreeable to the expert estimate of these events as generally made throughout the world.

The chapter on recent warship construction, written by the editor, assisted by Captain Orde Browne, is perhaps one of the most valuable in the whole work, and the table published on page 176, showing the comparative qualities of eight of the latest first-class battleships in the world, will form a subject of interesting study for every one who follows closely the subject of warship construction. The battleships taken are the "Formidable" and the "Duncan," of 15,000 and 14,000 tons displacement respectively, of the British navy; the "Iéna," 11,870 tons displacement, of the French navy; "Kaiser Friedrich III.," 11,130 tons, of the German navy; the Russian "Petropavlovsk," of 10,960 tons displacement; the Italian "Benedetto Brin," of 12,564 tons; the United States "Maine," 12,500 tons; and the Japanese "Shikishima," of 14,850 tons displacement. Accompanying this table is another showing the energy of gun-fire per minute for each ship. The largest vessel in point of dimensions is the "Benedetto Brin," which is 413½ feet long, by 27 feet draught, and has the enormous beam of 78 feet. Evidently her model must be exceedingly fine, as she displaces only 12,564 tons as against 15,000 for the shorter and narrower and shallower British ship "Formidable." The Italian ship has the thinnest armor, only 6 inches on the belt; she has the most powerful fire energy, the total amount being 600,745 foot-tons per minute. The "Iéna" has the smallest energy, 431,423 foot-tons. With new guns and smokeless powder, the "Maine" is estimated at 560,513 foot-tons, or about the same as the Japanese "Shikishima." The fire energy of the British ships is, as usual, relatively less than that of the others, being for the "Duncan" class 489,706 foot-tons per minute. This is compensated, however, by the high speed of 19 knots with natural draught, which would be equivalent to about 21½ knots with forced draught.

There is a marked tendency in the latest ships to reduce the thickness of the armor and spread it over a larger area of the ship's side. In the British vessels of the "Formidable" class the belt is 9 inches, and the side armor above the belt is 9 inches. In the "Duncan" class it has been reduced to 7 inches; in the "Iéna" the belt is 13¼ inches, and the side armor 4¾ to 3 inches thickness. The "Kaiser Friedrich III." has a maximum thickness of 11¾ inches in the belt; it has no side armor above the belt. The "Petropavlovsk" has a 15¼-inch belt; the "Benedetto Brin" has a 6-inch belt and 6-inch side armor above it; the "Maine" a 12-inch belt, with 7-inch side armor; and the "Shikishima" has a 9-inch belt and 6-inch side armor. All the ships carry 6 inches of armor for the protection of the

secondary battery, except the "Maine" and the "Iéna," the former having 5½ inches for this battery, and the French no protection beyond that afforded by shields. The 5½-inch side armor of the "Maine" is, however, continuous, while the 6-inch armor on many of the other vessels is placed only upon the casemates. Looking the comparison over carefully, we have every reason to be satisfied with our own "Maine," which we think stands as the best all-round fighting ship in the table. We cannot but feel, however, that she would be greatly improved if Krupp steel was substituted for the Harveyized armor, and the weight so saved were allotted to a battery of four 8-inch rapid-fire guns, these four to take the place of four of the 6-inch rapid-firers in the present battery.

In the chapter on coast fortifications the author divides the ports of the British empire into three classes: commercial ports, naval or dockyard ports, and supply ports or coaling stations. He does not believe in the extensive fortification of commercial ports as such, and would confine the erection of strong fixed defenses to the naval dockyards and the coaling stations. Regarding commercial ports, defended by mine fields, protected by rapid-fire batteries, with the fields so arranged that the mines could be kept permanently in place, or so that whole system of mines could be laid down in a short time, the author considers that the former method would be impossible because intolerable, as shown by the inconvenience experienced by New York in the late Spanish American war. It is considered that to carry out the second of the above named methods would "require an amount of time which would more than suffice to assemble the armed defenders whose presence would secure the place against hostile molestation far better than obstructed channels or fixed batteries." Whatever may be the case with regard to Great Britain, the writer is mistaken in his estimate of the situation at New York, where a very effective system of mines was laid down in a comparatively short period of time and would, we believe, have proved an effective safeguard to the city had we confronted a more energetic and formidable foe. Moreover, the mines were laid long before our volunteer army was in a position to take the field. Under our present system it is evident that submarine mines must constitute for many years to come the most effective defense available for our maritime cities.

THE AUTOMOBILE TRIP FROM CLEVELAND TO NEW YORK.

The first attempt in this country to use a standard automobile carriage on a continuous high speed trip of several hundred miles must certainly be considered a triumph for the new form of locomotion. The Winton carriage which left Cleveland on Monday, May 22, reached New York at 5:30 P. M. on Saturday, May 27, having covered the whole distance of 707¼ miles in the actual running time of 40 hours and 4 minutes. This is an average running speed of 17½ miles an hour, and in view of the fact that long stretches of the road were in a poor condition, and that some sections are spoken of as being disgraceful in the extreme, this is a highly creditable performance. The fastest average for a continuous run was made between Cleveland and Buffalo, where the distance of 218 miles was covered in 11 hours at the rate of a fraction under 20 miles an hour. The carriage weighs 1,700 pounds, and is driven by a 6-horse power motor. It is made in three different sizes; and good illustrations of the type appeared in the recent automobile number of the SCIENTIFIC AMERICAN.

The fastest speed for a long-distance journey was that accomplished by the winning carriage in the recent automobile race from Paris to Bordeaux, when a petroleum-driven carriage covered the distance of 353 miles in 11 hours 43 minutes and 20 seconds, an average speed of thirty miles an hour. This was a truly sensational performance, but there are circumstances which bring it within the limits of comparison with the Cleveland-New York journey. For it must be borne in mind that the Paris-Bordeaux roads are of the very finest surface throughout, and the vehicle, unlike the Winton carriage, was a special racing machine equipped with a fourteen horse power engine.

By sacrificing everything to power it is quite possible to build an automobile that will cover a straight-away mile at the rate of 60 miles an hour; and it has recently been reported from Europe that this speed has been attained more than once. These sensational speeds however do not interest the public so much as the question of maintaining a high average speed with motor-carriages of the standard make. The recent trip from Cleveland to the eastern seaboard proves that economical and speedy long distance automobilism will be within the reach of the public in the near future.

PHOTOGRAPHY IN RELIEF.

A new method for producing reliefs by the aid of photography has been devised by M. Lemac, who in this manner has produced fine medallions from living persons. His process has been described at a meeting of the Société Française de Photographie as follows:

The model, which it is not necessary to powder or

treat specially, is placed in front of a black background, presenting the profile to the camera. Two plates are successively taken, avoiding all displacement of the model between the two exposures. For these the source of light should have as small dimensions as possible, a cartridge of powdered magnesium being preferred; this should be maintained in a plane perpendicular to the axis of the objective and slightly nearer the latter than it is to the model. During one of the poses the model is lighted about three-quarters in front, and for the second, three-quarters to the side. Negatives are obtained on films, which are then placed exactly over one another. In this way the most salient points of the face are represented by an intense black, these having received the maximum of light in one or the other exposure; the less lighted portions are gray, and the hollows, having been each time more or less in shadow, appear as transparent places in the negative. With this combination a print is made upon a paper which permits of easy retouching, such as platinum paper. This print is then retouched in order to bring out the hair and drapery. If letters are desired on the medallion, these are drawn with Chinese white or India ink, according to whether they are to be raised or depressed in the medallion.

The outline of the plaque or medallion is traced in India ink, according to the shape desired. This proof in black and white is then reproduced to the desired size, giving a negative from which are made the proofs in relief.

For low reliefs, proofs are made on a sheet of bichromated gelatin in the usual way, but to obtain high relief, one proceeds in the following manner: A thin layer of gelatin is flowed upon a sheet of a spongy substance which swells easily in water. The gelatin is sensitized with bichromate, and after drying, is exposed under the negative last obtained, and then submitted to the action of water, which washes out the portions shielded from the action of light, causing depressions, while the unexposed and impermeable parts are swelled out by the action of the water, thus producing a high relief, which corresponds to that of the model. Upon the relief so obtained fine plaster of Paris is flowed, and the hollow mould obtained is retouched. This constitutes the final mould for the reproduction of proofs. This process is not difficult to carry out by one accustomed to photographic manipulation; the time occupied in retouching the black-and-white print as well as the plastic mould is not more than one hour for a medallion-head of natural size.

THE BIRTH-RATE IN EUROPE.

Scientists and statisticians of France have been for some time occupied with the question of the decrease of the birth-rate in that country. This naturally leads to the investigation of the birth-rate of the other countries of Europe, in order to find out whether France is the only country going down the scale. For this purpose the tables published by Signor Bodis, a prominent statistician of Italy, are of value; these tables have in fact been made the base of various investigations as to the movement of population. Below is the order in which the countries of Europe are classed in decreasing series, according to their mean birth-rate:

- | | |
|---------------------|-----------------------|
| 1. Russia in Europe | 12. England and Wales |
| 2. Hungary | 13. Scotland |
| 3. Servia | 14. Denmark |
| 4. Roumania | 15. Norway |
| 5. Austria | 16. Belgium |
| 6. German Empire | 17. Sweden |
| 7. Italy | 18. Switzerland |
| 8. Spain | 19. Greece |
| 9. Finland | 20. France |
| 10. Portugal | 21. Ireland |
| 11. Holland | |

Thus we find that Russia has the largest percentage of births, and France and Ireland the smallest.

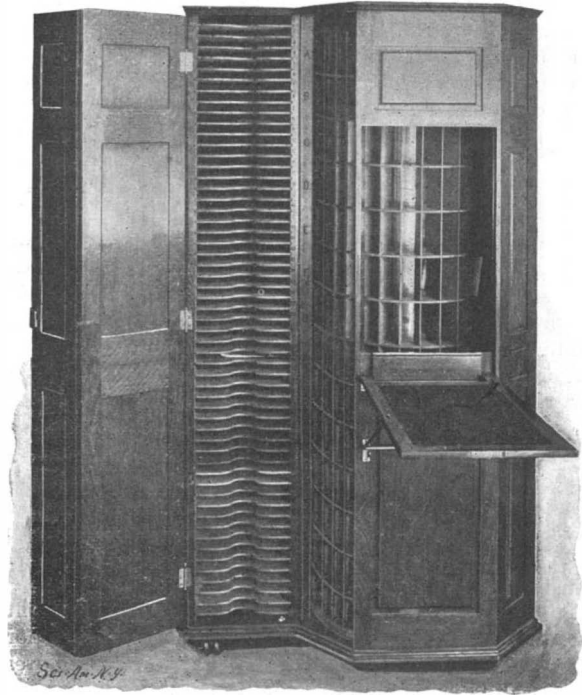
To find out whether in any of these countries the birth-rate is on the increase or decrease, the figures for each for different years are examined, and we thus find that in all except five the movement of natality is on a decrease more or less rapid. M. Vauthier, analyzing the figures obtained by Signor Bodis, draws the following conclusion as to the diminution of the number of births:

The country of Europe in which the decrease is most striking is England, including Wales, whose coefficient of decrease is 0.306 per 100; Scotland, whose mean birth-rate is nearly the same, decreases but 0.027 per 100; and Ireland, whose birth-rate is much smaller, decreases only 0.0233 per 100. Somewhat after England and Scotland, but before Ireland, are found Holland and Germany, having a coefficient of decrease of 0.0244 per 100, followed closely by Belgium (0.0239). Then, passing by Greece (0.0209), one reaches France, whose natality decreases annually by 0.0179 per 100. After France comes Russia (0.0158), Sweden (0.0147), Switzerland (0.0128). Last are found, having less than 0.01 per 100, Denmark (0.0078), Austria (0.0077), Pomerania (0.0033) and Hungary (0.0024).

As to the countries in which the birth-rate is on the increase, we find the following series: Italy, by 0.0083 per 100; Spain, by 0.0040; and lastly Servia and Norway, with coefficients of 0.0017 and 0.0012 per 100, being thus nearly stationary.

A SIMPLE CABINET FOR FILING PAPERS.

In the accompanying illustration we present a novel cabinet by means of which correspondence, blanks, documents, clippings, and the like, may be readily filed away and alphabetically indexed. The cabinet comprises essentially two parts, a rectangular portion and an octagonal portion. Within the rectangular portion, a box-section rotating on trunnions is mounted, which box-section has an open front and is adapted to receive a number of removable shelves, numbered from top to bottom. A folding-door is provided, which, when the box-casing faces the octagonal portion with its open



A CABINET FOR FILING DOCUMENTS.

front, closes both the rectangular portion and an opening in the octagonal portion.

Within the octagonal portion and adjacent to the rectangular portion, an upright is mounted upon which is inscribed one-half of the letters of the alphabet, the other half being inscribed upon a second upright also secured to the octagonal portion, but at the right hand side of the opening closed by the door.

In the octagonal portion a revolving cabinet is mounted, divided into pigeon-holes in horizontal alinement with the letters on the uprights. The letter "A" for example is adjacent to the upper row of pigeon-holes, and the letter "N" likewise, the two letters serving to index all the pigeon-holes in the upper row. The documents indexed by the letter on the left hand upright will be at the left hand side of the revolving cabinet; while the documents indexed by the letter on the right hand upright will be at the right hand side of the cabinet. At the top and bottom of the revolving cabinet, at the end of each vertical row of pigeon-holes, the twenty-six letters of the alphabet are inscribed.

In filing away papers belonging to "Walter Brown," for example, the cabinet is turned until the letter "W" at top and bottom is brought into view, and in the pigeon-hole at the junction of the vertical column "W" and the horizontal line "B" "O," the documents are filed and placed nearest the letter "B." Under such an arrangement, it is evident that the filing of documents may be accomplished so that no difficulty is experienced in searching for any particular paper.

In front of the octagonal portion a drop-section is hinged, which can be lowered to form a desk.

The patents on this cabinet are controlled by Mr. Cyrenius A. Layton, of Wapakoneta, Ohio.

Electrolytic Cleaning of Metal.

Mr. C. B. Burgess contributes to The Electrical World some excellent notes on the use of electrolysis in cleansing metallic surfaces. The notes have special reference to the preparation of the surfaces for electroplating. The author points out that if the article to be cleaned is suspended in a sodium chloride solution and used as an anode, the metal will be attached and hence cleaned to a certain degree. The anode reaction will, however, have little or no effect on substances of an oily or greasy nature, but the chemical reactions at the cathode afford all that may be desired in this direction. With the above named electrolyte, sodium is liberated at the cathode, immediately uniting with the water, forming sodium hydroxide and hydrogen, which rises to the surface. The reducing properties of the so-called nascent hydrogen thus formed are well known, and whether by the hydrogen alone, or by aid of the sodium, any oxide, sulphide, chloride, or similar compound on the metallic surface serving as the cathode will be quickly reduced to the metallic state. The sodium hydroxide formed will attack the grease or oil, producing saponification exactly as is done in the electroplater's lye vat. In most cases, the chemical action

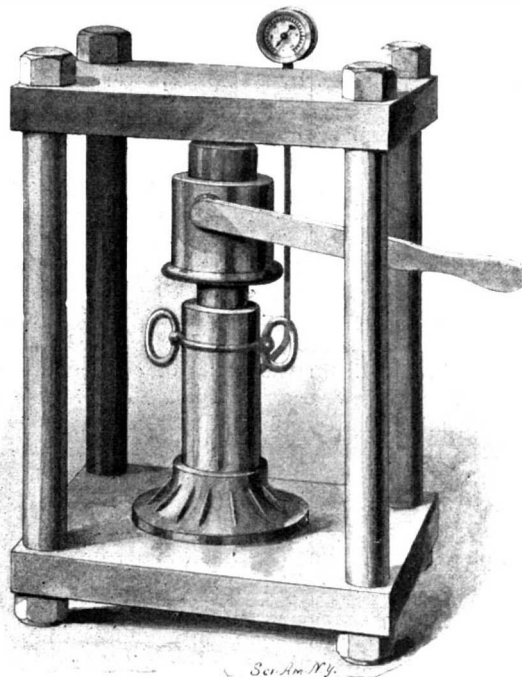
at the cathode will in no way affect the metal itself, but will act only on the foreign substances present, thus allowing polished surfaces to be cleaned without destroying the finish. The electrical energy necessary to effect the cleaning of articles of iron or copper as they come from the polishing room may be taken as approximately equal to that used for the electro-deposition. Although the current density must be considerably greater for cleaning than for plating, the time is much shorter. Current density has a marked effect upon the rapidity of cleaning, and the disappearance of foreign substances in no wise follows Faraday's laws. The following figures, taken from some observations made by Mr. H. A. Smith, illustrate this very clearly. The measurements were made to determine the effect of current density upon the rapidity of removal of a film of grease from an iron surface, such as it acquires from a greasy polishing wheel. The electrolyte was a nearly saturated solution of sodium chloride:

Current per square foot.	Time necessary for cleaning.
20 amperes.....	15:00 minutes.
40 ".....	3:50 "
140 ".....	0 75 " about.

With a solution of potassium hydroxide a current density of 80 amperes per square foot cleaned the iron almost instantly. Some of the advantages of the electrolytic method of cleaning over that commonly used in an electroplating plant are the following: There is less complication from the fact that the cleaning vat may be of similar construction to the plating vats, and connected to the bus bars in the same way. There is a considerable saving in labor and material in dispensing with the hand brushing. After once wiring an article there is no need of touching it with the hands, for it may be transferred directly from one tank to another. The oxides and other metallic compounds may be removed simultaneously with removal of grease and dirt, thus avoiding the use of a cyanide or an acid dip. A metal which has a brightly polished surface may be cleaned without destroying the polish.

AN IMPROVED HYDRAULIC PRESS.

The mechanical engineer, and specially the mining engineer, is often in need of a hydraulic press for the purpose of testing materials, for making briquettes, or for similar purposes. Our engraving shows a very simple hydraulic press which can be made by any one who has a hydraulic jack. Two wrought iron plates 12 inches square and 2 inches thick are bored to receive upright rods, one at each corner. These rods may be of any desired length up to 5 feet, and should be about 2 inches in diameter. The height should be regulated by the size of the jack and the class of work which is to be accomplished with the aid of the press. By the use of blocks of wrought iron or steel, it is possible to regulate with great ease the distance through which the pressure is exerted. The hydraulic jack may be provided with a gage which indicates pressures varying from 2,000 to 4,000 pounds to the square inch. It would be possible to make the top and bottom plates of cast iron, provided they were reinforced by diagonal ribs. We are indebted to Alexander Roy



A SIMPLE HYDRAULIC PRESS.

a mining engineer, for this suggestion. Mr. Roy has used a press of this kind in making briquettes for testing purposes.

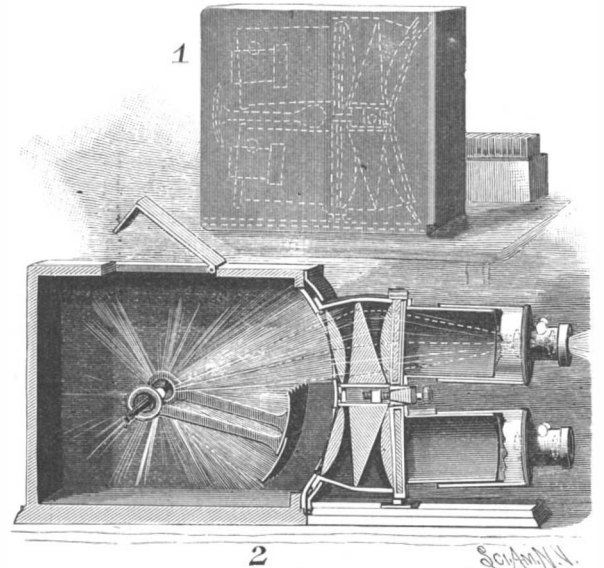
In Tasmania the trade in axes and saws has been almost entirely monopolized by Americans. It is now the intention to carry on international competitions between teams of axmen and sawyers, using British and American tools, with the object of proving which country manufactures the best implements.

A NEW FORM OF STEREOPTICON.

A multiple dissolving-view lantern has been invented by Dr. Samuel E. Woody, 600 West Broadway, Louisville, Ky., which includes various improvements in construction, by which the light is so refracted that the picture from each of the two optical systems appears on the same spot of the screen.

Referring to Fig. 2 of our engraving, it will be observed that two condensers are mounted at the end of the light-casing, the upper being fitted to slide in a segmental guideway on the light-casing so that it can be adjusted relatively to the lower, by means of a wedge interposed between the frames of the condensers. By reason of this adjustment a proper registration of the two pictures projected by the two optical systems is obtained.

Each condenser is provided with two plano-convex



A NEW FORM OF STEREOPTICON.

lenses, having a prism interposed between them, so that the rays of light passing to the first lens are refracted by the prism to the other lens adjacent to the slide-holder. The two lenses of each condenser are inclined to each other, and the interposed prism refracts the rays of light at a proper angle.

The apparatus is provided with a shutter held movably in the light-casing between the light and the condensers. By operating the shutter the rays can be made to pass through one or the other of the condensers.

In the modified form shown in Fig. 1, the light-casing, in addition to the ordinary function, serves as a receptacle for the condensers, the slide-holders, and the adjustable tubes carrying the objectives, thus facilitating the transportation of the apparatus. In order to obtain this compact arrangement, the bottom of the light-casing is formed with a dovetail groove adapted to register with a similar groove in an extension hinged to the outer end of the bottom, and forming a cover for the open end of the casing when the several parts are stored. In the registering dovetail grooves a support slides which carries the stereopticon parts. In using the device the extension is swung down and the support carrying the stereopticon is slid out, reversed, and reinserted in its proper operative position.

Interesting Discovery in the Tower of London.

It would really seem impossible to make any new discovery in the Tower of London, which has been examined so many times by architects and antiquaries. Some unusually interesting discoveries have just been made in the process of laying the foundation for the erection of a new guard-room near the White Tower. The workmen cut the Roman wall of the second century and found a number of perfectly preserved flue tiles for the diffusion of hot air from the hypocaust.

These tiles are excellent specimens, measuring 15 inches in length, 6½ inches in width, and 4½ inches in depth. According to a cable dispatch to The New York Sun, while removing the mud from the subway leading from the river and the moat, the workmen discovered a number of iron and stone shot, left, it is believed, at the time of the conflicts between the royal troops and the rebels under Wyatt, in 1554. The shot are thickly set in a conglomerate of mud and gravel, mixed with human bones and bits of armor, showing firing with deadly effect at close quarters.

The Fish Commission Expedition.

The United States Fish Commission is about to send out one of the most extensive scientific expeditions ever arranged by the Commission. The expedition will sail on the "Albatross" in charge of Prof. Agassiz to explore portions of the Pacific Ocean. Some of the islands to be visited are the Marshall, Society, Friendly, Fiji, and Gilbert groups. It is expected that the trip will require eight months, and will leave San Francisco in August.

An Emotional Curve of Literature.

It seems as though psychology is now invading every stronghold of science, literature or art. A graduate student at Columbia University, Mr. Gerrard, has submitted an interesting original thesis entitled "Emotional Expression in Literature," and the results of this method are very interesting. He notes carefully his own emotions while reading literary works and then studies out what passages caused the emotions. These passages were then copied off or cut out until he has a very large number of clippings and memoranda, says *The Sun*. He noted the number of emotions and emotional elements for each hundred words in the various works or by the several authors. He grouped the clippings in different ways as similarity of themselves or as the emotions they excited suggested, and so eventually perceived what he calls the laws which govern the production of emotions by language or the expression of emotions in written speech. He says in his introduction:

"This work is the outcome of a desire to find the elements used in expressing ideas and emotions in literature; to learn how these elements are used, and to see if, the elements serving as a basis of valuation, some method could not be devised whereby the strength of literary works could be measured. . . . It was early noted that descriptive work used different elements than did narration or character interaction. . . . This discovery of the elements was extremely trying work, since one in seeking must be ever on the alert, must know exactly when the emotion comes to him, and must try to locate the exact part of the passage in which the effect was to be found. This necessitated a high degree of mental and emotional sympathy with the work under consideration, together with enough self-control and introspection so as to be able to judge without being carried away by the work. Once the elements were discovered, the laws governing them began to appear one by one.

"The value and use of the elements has been tested in other ways. A very acrid speech by a Southern Senator deprived of a very few adjectives became extremely pacific."

Of his literary elements he says: "Man receiving sensations from all his senses at one time may unite them and represent the united sensations in one expression; or he may unite them with other stored stimuli and produce an expression resulting from hundreds of stored stimuli. Such an emotion would in literature find expression in a discourse, while several sense impressions from the eye, ear and finger combined would, perchance, produce a noun or a verb; while each sense impression might find expression in an adjective or an adverb. . . . It will be noted that the strength of the ordinary figure of speech is due to the fact that in it the condensation of a larger whole into a smaller one is strongly felt. A verb idea is put into an adjective, or a paragraph idea is put into a verb. A proverb is a condensed drama, a joke a comedy in miniature. Each paragraph was once a whole literary work; each perfect word contains a condensed play. . . . A dramatic moment is a larger whole than is a paragraph. . . . To show the emotion and emotional changes in a work of literature, graphic curves have been made as follows: Taking 100 words as a unit, I have found the number of nouns, verbs, clauses, sentences, paragraphs, or dramatic moments per 100 words. . . . These curves show us at a glance in what part of a work anyone element dominates; thus one finds the adjectives, and nouns, dominate in the beginning of 'Marjorie Daw,' while at the climax of the story the verbs greatly preponderate, as again nouns predominate in the anti-climax."

Mr. Gerrard represents graphically, in his thesis, by his curves, the emotional measurements of "Pippa Passes," "Camille," "Magda," "Hamlet," "Desdemona," "Red Riding Hood" and many other works and characters of literature.

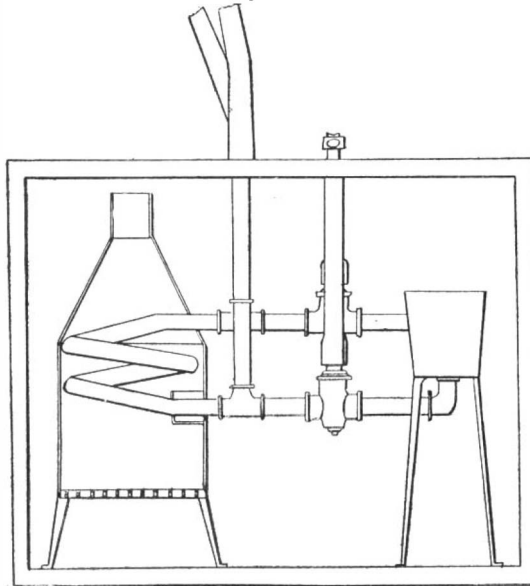
A New Polar Expedition.

There are already four polar expeditions under way, or almost ready to start, and to these must soon be added that of Capt. Bernier, a Frenchman. His course will be toward Franz Josef Land, steering for the part lying to the east of Cape Mary Harmsworth, pushing on as far north as possible, and he will then disembark with all the provisions, dogs, reindeer, sledges, etc. He intends to pass the winter at Petermann's Land, which is probably an island lying in about 83° north latitude and 58° or 59° east longitude, that is about 420 miles from the pole. At the first opportune moment he intends to make a dash for the pole. If possible he hopes to cover the 420 miles in 100 days, which is good traveling in this part of the Arctic regions. He expects to return from the pole by a route which will permit of reaching Spitzbergen and he thinks he will reach Dane Island, where André started in his balloon, toward the middle of autumn. If he reaches this

point, he will have to spend the winter there, as steamers run between Norway and Spitzbergen only during the warm season. He has an alternative plan of operation by way of the River Lena, and which the "Jeannette" followed in 1881.

THE BRICKILL FEED WATER CASE.

On May 19, Mr. George E. Howard, special master in a suit brought against the city of New York, by the heirs of William A. Brickill, to recover money saved to the city by the use of a patented feed-water heater for

**BRICKILL'S ORIGINAL HEATER.**

steam fire-engines, filed his report in the United States Circuit Court. The master awards the complainants \$894,633, of which sum \$194,716 is interest. This ends one of the most interesting legal battles for the defense of patent rights which has ever been fought. The case has been in the courts for twenty-nine years, and it is to be hoped that it is now definitely settled.

William A. Brickill was foreman in the New York Fire Department. He had been an enthusiastic fireman in

the old volunteer days, and when the city established the regular paid fire department, he was retained as an engineer. He was a skillful mechanic, and devoted a good deal of his spare time to perfecting fire apparatus. In 1868 he invented and patented a feed-water heater for steam fire-engines, by which water could be kept very hot in fire-engines without fires being kept lighted under the boiler.

Mr. Brickill left the Fire Department and asked that the city pay him for the use of his patented device. The authorities contended, however, that he did the work while in the employ of the city and that he was doing nothing more than his duty. The patentee entered a suit for damages for infringement of his patent, and the suit dragged wearily on, so that at the end of ten years he had spent all his savings in litigation, and at the end of seventeen years the patent expired. He offered to settle with the city for \$50,000, but this was refused, and it is probable that the city will now be mulcted in a large sum.

The device is most interesting, and the decision is important from a legal point of view, as it affects the right of the inventor to the fruits of his invention. It has been decided by the courts that employers are not entitled to the inventions or patents of an employé, unless there is a special agreement to that effect, which was not the case in the present instance. An employer, who has in his pay a skilled workman engaged to devote his time and services in devising and making improvements in articles manufactured by the employer; is not entitled to the conveyance of any patents obtained by the employé, unless there is a distinct agreement to that effect.

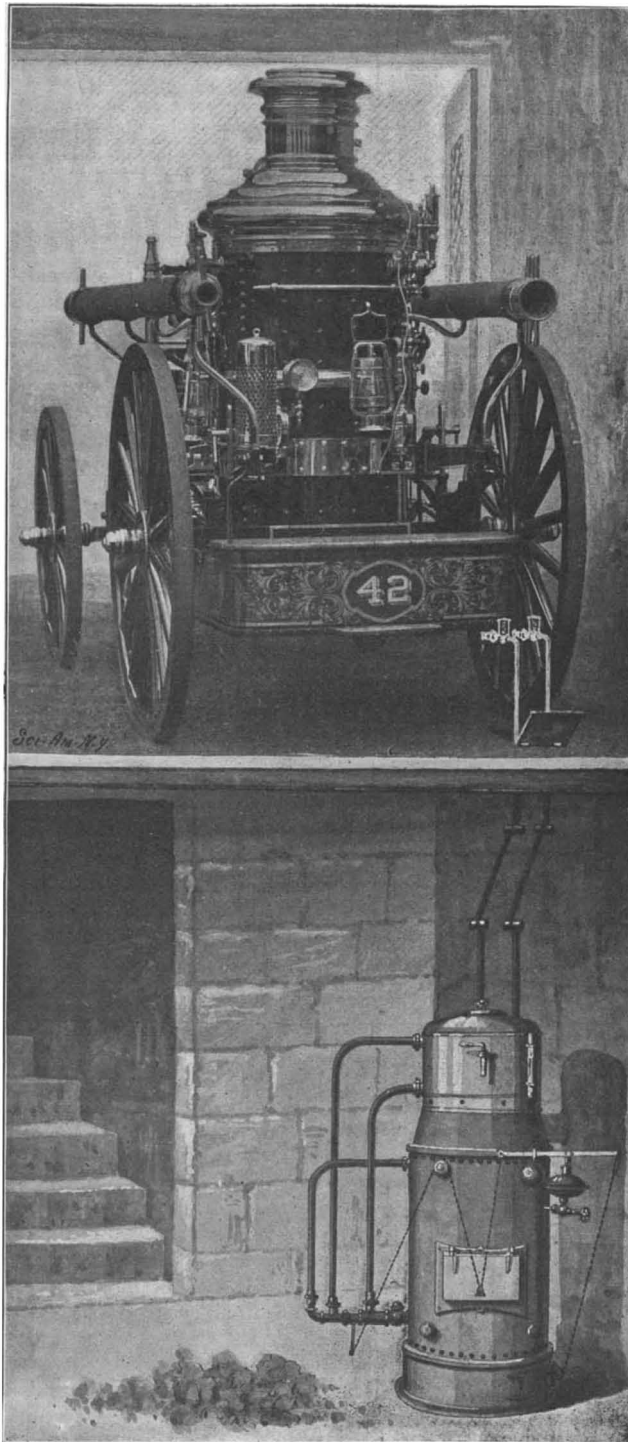
Nowadays no engine house where a steamer is located is properly equipped unless supplied with a heater. It is necessary to keep the engine room constantly warm in cold weather to guard against frost, so that some form of heating apparatus is required, and Brickill's invention calls for an attachment to such a heater which would at the same time supply water to the fire-engine boiler very near the boiling point, in order that when an alarm is turned in, the engine can start to the fire, and by the time the scene of the fire is reached, a sufficient pressure of steam has been raised which will permit of working the pumps. Our small diagram shows the original device of Mr. Brickill. Naturally it has been much improved upon as the device shown in our engraving represents an approved form of heater for steam fire-engines. The heaters are usually placed in the basement and are usually made in sizes which can supply either one or two engines. The heater is automatic, coal or coke being supplied to the fire through a self-feeding mechanism. Damper regulators keep the temperature steady and uniform; they can be adjusted so as to maintain any required pressure from the boiling point upward. The steam capacity is from 25 to 50 pounds of steam. The heaters may also be placed on the same floor as the engine, but in the majority of cases they are placed in the basement directly beneath the engine as shown in our engraving.

The circulation of hot water in the boiler of the fire engine also tends to prevent the deterioration of the boiler. The pipes usually come up through a trap in the floor, and valves are provided so that the forward movement of the engine immediately closes the valves in the pipes attached to the engine, and also to the heater, and changes the circulation of the water from the engine to the tank on the heater, and opens the damper on the heater when the action of the regulator will at once close the draft. Other devices have been provided, such as valves which are operated by the foot as the engineer mounts the tailboard. If desired, the engine can be run to the scene of the conflagration without lighting the fires, and steam can be rapidly raised if it is found the alarm is a true one. This, however, is not done much in large cities.

Director of Allegheny Observatory.

Prof. F. L. O. Wadsworth, of the Yerkes Observatory of the University of Chicago, has been appointed Director of the Allegheny Observatory. He succeeds Prof. J. E. Keeler, who recently went to the Lick Observatory. Prof. Wadsworth will take charge on January 1, next. He has been connected with the Yerkes Observatory since its opening in 1897, as instructor in astrophysics. He came to the University in 1894, from the Astrophysical Observatory, in Washington.

TESTING SODIUM SULPHITE.—To test sodium sulphite for its chief adulterations, proceed as follows: By adding the few drops of barium chloride solution to the solution of the sodium sulphite to be tested, a white precipitate results. Same must be soluble in hydrochloric acid. If it is not, sodium sulphate is present. If phenol-phthalein paper moistened with sodium sulphite solution is dyed red, sodium carbonate is present.—*Deutsche Photographen Zeitung*.

**IMPROVED FORM OF FEED WATER HEATER.**

PHILOSOPHY OF EXPLOSIVE WAVE ACTION.

BY HUDSON MAXIM.

In the SCIENTIFIC AMERICAN of April 8, immediately following the bursting of the 10-inch gun at Sandy Hook, I published an article expressing my views as to the probable cause of that disaster. In the Automobile Number of the SCIENTIFIC AMERICAN I illustrated, with diagrams, how different methods and densities of loading and of ignition may set up violent wave action in guns.

In the SCIENTIFIC AMERICAN SUPPLEMENT of May

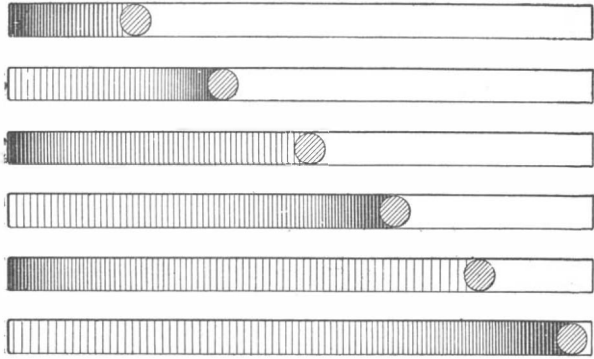


Fig. 1.

20, I took up the subject again, chiefly to reply to and correct some misleading statements made by Mr. Hiram S. Maxim, concerning the Maxim-Schüpphaus smokeless powder and other matters. Supplementing the above articles appeared an excellent contribution by Mr. Fred. H. McGahie on Wave Action in Guns, in the SCIENTIFIC AMERICAN SUPPLEMENT, May 27. Those interested in the subject will find sufficient data in the above contributions to establish the fact beyond a doubt, I think, that the cause of the explosion of the gun was due to wave action, and was not due to any inherent fault of the Maxim-Schüpphaus smokeless powder which was employed.

All of the conditions favorable to wave action were present when the gun burst, and these conditions are very clearly presented in the following paragraph, page 248, Report of the Chief of Ordnance, of 1894:

"The conditions favorable to wave action appear to be length of chamber, quickness of the powder, high density of loading, ununiform distribution of the charge, and end ignition. In our system of large guns three

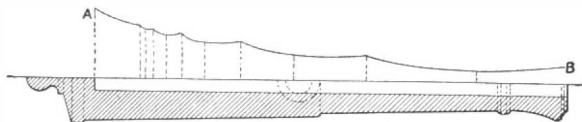


Fig. 2.

of these conditions are always present, and it is probable that more or less wave action always occurs, though it may not result in abnormal maximum pressures. And when the charge does not occupy the whole length of the chamber abnormal results seem likely to occur, the more likely as the powder is quicker."

In the present article I shall endeavor to show something of the philosophy of explosive wave action.

The subject of wave action was thoroughly investigated by M. Vieille, and his determinations were published in the *Memorial des Poudres et Salpêtres*, Tome III., 1890. Vieille, however, was not the first person to give this matter rational treatment. By referring to the Appendix M, to the Report of the Chief of Ordnance, United States Army, 1879, we find that Dr. W. E. Woodbridge went about as far toward a rational solution of the problem as was possible with the means at hand at that time.

Dr. Woodbridge says:

"It is evident that a difference of tension amounting to 3,800 pounds in the distance of three inches will not allow the gases to remain in quiescence, but must give rise to vibrations of great force, and alterations of tension, such as are represented in the diagrams. . . . The effect of an enlargement of the space during the vibrations such as actually occur will evidently be to

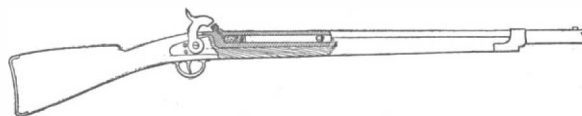


Fig. 3.

increase the amplitude of the vibrations and to diminish their frequency and force. The amount of this effect, and the number of vibrations occurring before the ball leaves the gun, will depend, other things being equal, on the weight of the ball. The figures above are designed to illustrate the character of the variations of tension occurring while the ball is leaving the bore. (See six diagrams, Fig. 1.) Adopting another mode of illustration, and representing tension by perpendicular distance from a horizontal line, the wave line, A B (Fig. 2), will denote the maximum pressure sustained by the different parts of the bore. The supposed limits of the cavity during the successive vibrations are given in vertical lines."

Persons familiar with the old style muzzle-loading musket are aware of the necessity of getting the ball well down upon the powder charge. If, from the gun

being foul, or from other cause, the ball should stick in the bore, say a foot above the powder charge, and the gun be fired, it is likely to burst. To illustrate this, let us refer to Fig. 3, showing a side elevation of an old-fashioned musket with the powder charge, and a portion of the barrel in section, and showing the bullet stuck in the bore some distance forward of the powder charge. Here we have a similar condition to that presented in a modern cannon, charged with a single bag of powder placed near the breech plug and ignited at the rear.

Upon ignition, the powder charge will rocket along the bore, while the rapidly burning grains strew the chamber, the main portion of the charge being thrown with great violence with the dense products of combustion upon the ball, tamping themselves by their inertia into the space immediately behind the ball. Before the projectile is displaced to any considerable extent, the pressure directly behind it will mount very high, which will cause the grains to burn with greatly accelerated rapidity. The enormous pressure resulting will be greatly in excess of the pressure at the rear of the powder chamber. This will cause a wave of explosion to rebound from the ball and rush backward through the powder chamber to the breech of the gun. This wave, meeting the outward-rushing gases laden with burning powder, will throw them back upon themselves, and impinging upon the immovable breech block, cause a repetition in much exaggerated form of that condition just described as taking place behind the ball. The explosive wave, if it does not blow out the breech block or burst the gun, will again rebound to rush forward through the bore to overtake and impinge again upon the projectile before it has had time to leave the gun, again mounting the pressure very high immediately behind it.

There are two ways in which explosive compounds are consumed, namely, surface combustion and detonation. Gunpowder is burnt in the first way, and dynamite in the second. Detonation means the breaking up of the chemical arrangement of the molecules composing the compound, by a wave action transmitted with great velocity through the body of the compound. With gunpowder under service conditions, in guns, detonation is practically impossible. To cause the detonation of a grain of any standard smokeless powder, such as are employed in large guns, would probably require a pressure, instantly applied, of more than 100 tons to the square inch, while the pressure to which it is usually subjected in guns is from 15 to 17 tons.

It is probable that no gun is strong enough to allow the pressure to mount to a sufficient height within the

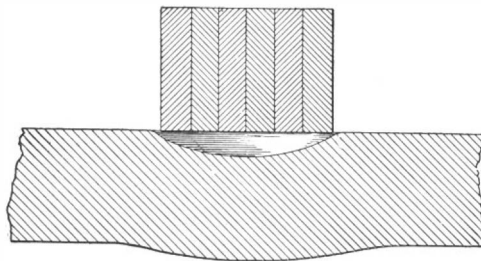


Fig. 5.

bore to detonate a service powder charge before the bursting of the gun; and it is probable that if the granulation be coarse enough, the strongest piece of modern ordnance could be burst in this way without the complete consumption of the grains; and some of them would be blown out in a partially consumed condition, with the pieces of the walls of the gun. Although dynamite is exploded in an entirely different manner from gunpowder, yet we may draw valuable conclusions from the action of the gases set free by the detonation of dynamite, as to what high velocity means with dense gases.

If a dynamite cartridge, set on end upon the ground, be exploded from the bottom, the wave of detonation

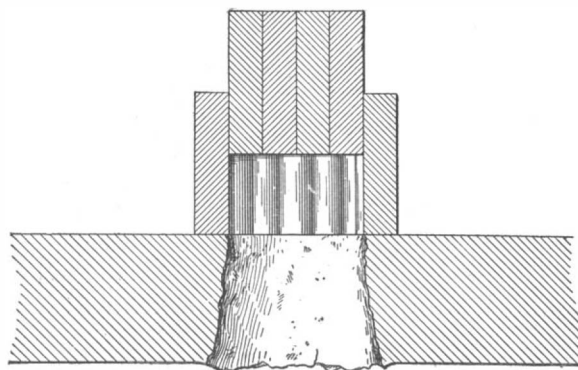


Fig. 6.

moving upward will detract from the downward effect of the explosive upon the earth. If, however, the cartridge be exploded from the upper end, a much larger hole will be blown in the earth. When dynamite is detonated adjacent to a body offering great resistance, the body of the explosive, being instantly converted into incandescent gases, will rebound from the resisting body with great velocity, and the destructive effect upon the latter body will be less if the detonative wave moves from the body, than if it moves toward it. If two bodies of dynamite be placed adjacent to each other and detonated simultaneously, the gases of the explosion will meet in the space which separates them to be thrown out with greatly increased velocity in a lateral direction.

Under the advice of Prof. Charles E. Monroe, the

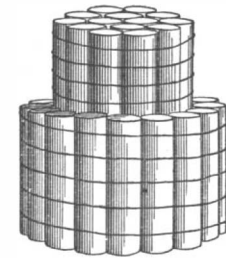


Fig. 7.

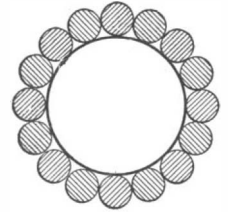


Fig. 8.

celebrated high explosives expert, and the inventor of jovite, some experiments were conducted in the destruction of safes and safe deposit vaults some years ago. The following data is obtained concerning these experiments, from a letter of the Secretary of the Treasury, 1894.

It was found that a package of dynamite cartridges, tied together, as shown in Fig. 4, and placed upon the steel wall of the safe, would, when exploded from the bottom, only serve to slightly indent the wall of the safe (Fig. 5).

When, however, the same quantity of dynamite was tied about a tin can, as shown in Fig. 7, and in section, Fig. 6, and plan, Fig. 8, the effect of the explosion detonated from the top was to blow a 3-inch hole through the wall of the safe, Fig. 6. This greatly increased effect was due to the fact that the gases of the explosion (Fig. 6) met in the space formed by the tin can, which imparted to them greatly accelerated velocity under great density. The direction of the movement of the united gases being toward the safe, instead of simply indenting it, blew a hole completely through.

When the products of combustion in a gun are thrown violently backward and forward by wave action, the velocity and inertia factors serve to run the pressure up very high at different points along the bore.

How Large Fossils are Preserved.

Each summer the field expeditions sent by the American Museum of Natural History go to the great fossil beds of Wyoming and Kansas, where in past geological ages were the great fresh water lakes, in and about which lived the extinct animals whose skeletons they are seeking. Here, says The Evening Post, they begin by prospecting along the bluffs or over the beds of hard clay in which the bones are found. When one is found protruding above the surface the clay is carefully cut away, but sufficient is left to cause the fossil bones to be firmly embedded in it. They are usually broken into many fragments, and if they were laid completely bare, as was formerly the custom, there would be great danger of losing some of the pieces, and there would be considerable difficulty in determining the relative positions of the rest. The new method of handling them is to leave them embedded in enough of the original clay to hold them together and to cover the whole with a plaster cast. This is boarded up and shipped with wet rawhide around it, which shrinks as it dries and binds the whole firmly together. These blocks weigh from 100 to 1,500 pounds. They are then crated and shipped to the museum, where the matrix is removed, and the bones are put together at once as they are removed, thus avoiding the difficulty of solving a dissected puzzle. A complete photographic record is kept of every stage of the proceedings, so that an adequate idea of the location of the bones in situ is obtained. One of the many specimens thus unearthed and preserved is part of a skeleton of a huge herbivorous reptile, called a camarasaur (Cope) or brontosaurus (Marsh). Of this skeleton the museum has two of the dorsal and nineteen of the cordal vertebrae and parts of the pelvis and leg bones.

To most people the interesting thing about this skeleton is the fact that the bones show unmistakable evidences of having been broken and gnawed by the teeth of some other animal, presumably one of the flesh-eating reptiles whose bones are found in the same clay beds. It is hard to picture such a scene of conflict. It might be likened to a fight between an elephant and a tiger, if the elephant was 80 feet long and 16 feet high and the tiger in proportion.

Correspondence.

Tide and Wave Drainage.

To the Editor of the SCIENTIFIC AMERICAN :

Whatever relates to the prevention of yellow fever in Cuba is of interest not only to Cubans but to the people of the United States, for there is the prolific hot-bed from which the seeds of the disease come to spread devastation among us.

Much can be done by attention to ordinary sanitary precautions, but this alone, without purification of the foul water of those harbors in that tropical climate, will be insufficient.

The curious combination of an inclosed lake and a long, narrow inlet connecting it with the ocean is the characteristic of the harbors of Cuba where yellow fever prevails in its more deadly form.

This formation would not be so conducive to impurity in the inclosed water if it were not for the low range of tide which prevails there, the difference between high and low water usually being about a foot only. The sea water which enters at high tide pushes the foul water back, and as the tide falls the pure water runs out again, leaving the bulk of the foul unchanged.

As a means of correcting this evil we beg leave to propose the following plan. To provide for somewhat similar conditions, there has been in operation for years, at Virginia Beach and other places on our coast, a device which, with some amplification, would accomplish the desired object in Cuba. It consists of an inclined plane of stout timber erected on the margin of the ocean where waves strike in full force. The foot of this slope is placed at a suitable height to catch the waves, which are carried by their own momentum into a canal in rear, through which the water is then conducted to any point desired.

Along the coast near the mouth of a harbor a sufficient length of these inclined planes might be constructed, and from them the pure sea water would flow into, and around, the harbor to its head, in volumes only limited by the size of the plant. The flow would be constant, excepting when the sea was becalmed, and it would drive out before it every particle of foul water in the harbor.

The cost of this canal, in comparison with one of equal size whose banks were to be subjected to hydrostatic pressure, would be light, for the elevation of the water need be only what was required to produce a current. The height of the embankment between the canal and harbor need be but little greater than ordinary high tide storm; tides might be allowed to overflow it. No puddling would be required; a simple bank thrown up from the excavation would be sufficient.

Considering its utility, the first cost of this plant would be moderate, and that of its subsequent maintenance very small indeed. The losses of the people of the United States by one yellow fever epidemic would build a hundred of them. WM. W. BLACKFORD.

Lynnhaven, Va., May 15, 1899.

Proposed Cable to Iceland and Greenland.

The following, dated Copenhagen, April 27, 1899, has been received from Vice and Deputy Consul Blom : The meteorologists in Europe have for many years desired a telegraphic connection with Iceland, Faroe Islands, and Greenland. Daily telegraphic reports from Iceland would be of the utmost importance to the weather service, as well as to the large fishing interests in the North Atlantic. I understand that the British fishing interests have recently petitioned the government to grant a yearly subvention to the proposed cable. The Danish government looks favorably upon the plan, but is of the opinion that it should be realized by private individuals. The Great Northern Telegraphic Company, Limited, of Copenhagen, is willing to lay and work the cable, provided it is guaranteed a certain sum from the various governments and other parties interested. The royal Danish meteorological office, in Copenhagen, has issued circulars to kindred institutions throughout the world, requesting them to subscribe to daily weather bulletins from Iceland and Faroe Islands; the matter is also being seriously considered by other bodies, especially in Great Britain, and the prospects for a realization of the enterprise are promising.

Adaptation of Leaves to the Intensity of Light.

The term "photometric" is proposed by Prof. J. Wiesner for those leaves which assume a definite position in light, either in order to obtain as much illumination as possible or to screen themselves from too much light; those which do not possess this property being "aphotometric." Photometric leaves, again, may be "euphotometric" or "pauphotometric," according as they adapt themselves only to the maximum of diffused light or to both direct and diffused sunlight. The former are characterized by assuming a fixed position, at right angles to the direction of the strongest diffused light, while the latter have no such fixed position. The vegetation of forests and those plants which grow in deep shade present the most frequent and clearest examples of "euphotometric" leaves.—*Biologisches Centralblatt.*

Miscellaneous Notes and Receipts.

Improvements in Acetylene Burners.—In order to prevent the danger of an explosion in acetylene burners, it has been proposed to lead the gas on its way to the end of the burner through a few small chambers filled with glass wool (spun glass). Owing to the fact that spun glass acts like a filter, the acetylene is, before burning, freed from all impurities which might have been carried along. Besides, these spun wool filters also serve the purpose of preventing a falling back of the flame and rendering it harmless even in case an explosion should occur through some cause or other.—*Neueste Erfindungen und Erfahrungen.*

Blackening Ornaments of Iron.—To give iron ornaments a black-brown to black color, proceed in the following manner: The articles are treated with corrosives, cleaned of all adhering grease and placed in a 10 per cent solution of potassium bichromate, dried in the air and finally held over an open, well-glowing, non-sooting fire for 2 minutes. The first coloring is usually black brown, but if this process is repeated several times, a pure black shade is obtained. Special attention has to be paid to removing all grease, otherwise the greasy spots will not be touched by the liquid, and the coloring produced will become irregular. Benzine is employed for that purpose and the articles must not be touched with the fingers afterward.—*Chemiker Zeitung.*

Hygienic Value of Paints.—Regarding the effect of various paints upon bacteria, Dr. Heimes has recently delivered a notable lecture before the Greifswald Medical Society. It does not appear to be an unimportant matter for the sanitary conditions in a building with what kind of paint the walls are covered. Heimes conducted the following experiments: He took equally large pieces of oak, poplar and pine wood, and of iron and cement plates, and covered each piece with oil paint, size paint, lime paint or enamel paint, as well as with a few proprietary compositions. After the paint had dried perfectly, the plates were coated with cultures of various disease-inciting bacteria. In this condition the plates were laid in an incubator, in which an ordinary room temperature was maintained. From time to time a little was scraped off from the surface of the plates in order to examine them as to the amount of live bacteria present. The result was that upon oil paint coatings the bacteria were found to die off quicker than on articles coated with other pigments. On enamel paint the bacteria die more slowly, and still slower on lime and size paint. This heterogeneous behavior is probably not due to the chemical properties of the paints, but to the different physical qualities, especially to the fact that the liquids containing bacteria dry more slowly or quickly upon the various paints. Prof. Loeffler, who attended the lecture, attached considerable practical importance to the result, and recommended the use only of oil paint in hospitals, schools, barracks and other buildings.—*Farben Zeitung.*

Treatment of Driving Belts.—The *Werkmeister Zeitung* gives directions on the best treatment of driving belts, whose faultless working is of great importance in every factory. The good drawing of a belt increases with the friction between belt and pulley. Hence it is obvious that the belt must surround as large a portion of the pulley as possible. For this reason crossed belts always pull better than open ones. If in any way practicable, open belts should cover at least almost half the pulley. If the circumference of one pulley be very small in proportion to the other, thus allowing the belt to cover only a small portion of the smaller pulley, a sliding of the belt frequently takes place, especially if the distance between the two pulleys be slight. It is plain, continues the *Werkmeister Zeitung*, that a slow running of the engine makes a strong stretching of the belts necessary. For this reason, a tightening-pulley is frequently placed midway between the two pulleys, so as to avoid a repeated resewing. If a large power is to be transmitted at little velocity, a broader belt should be employed than would be necessary with greater velocity, or else two belts are made to run on top of each other.

If one does not care to tighten the belts still more or use one of the many belt lubricants, the best makeshift is to cover the pulley with sail cloth. This is done by cutting the sail cloth so exactly that it is difficult to get it on the pulley. By thoroughly moistening the sail cloth on the pulley with warm water it clings more closely to the pulley, as the water causes it to shrink. It is still more practical in the long run to fix instead of the canvas a leather strip of corresponding breadth on the middle of the pulley, by having a few holes bored into the rim of the pulley which are tightly filled up with wooden wedges, in order to be able to nail the strip of leather on it. This process is said to have proved useful with ordinary proportions of the size of the belt to the effect of power to be transmitted. If all is unavailing, the belt is too weak, and must be replaced by a broader or double belt. Of great advantage in such cases are the wooden belt-pulleys, which increase the driving power.

Science Notes.

It is said that the construction of the dam across the Nile at Assouan, Egypt, will not submerge the temple at Philæ. The actual level of the water behind the dam will be a little above the present high-water mark, so that the floor of the temple will still be dry.

It is said that some 9,000,000 acres of land in Italy, the cultivation of which has been abandoned because of malaria, are to be developed by the aid of American capital. Land of this nature can be reclaimed by drainage and proper attention to sanitary laws.

An English railway company has recently completed a train for the use of the royal family, the cost of which was \$40,000. There are five cars, and each is lighted by electricity, the dynamo being axle-driven and supplemented by a storage battery in the baggage compartment.

It has been decided that the Fisheries and Forestry exhibit of the United States at the Paris Exposition shall be utilitarian only. An exhibit of natural fish will be avoided, but tinned, preserved and dried fish and fishing tackle will make the Department of Forestry and Fisheries one of the most attractive sections in the United States Division at the Exposition.

At last the Electrolytic Salts Company have received a report on the "process" of extracting gold from sea water. The professor whom the directors employed reports that the process was fraudulent. The directors are said to have recovered a considerable sum from the originator of the swindle, which, together with the sale of the machinery, etc., has realized enough to pay 20 per cent dividend to the stockholders.

It is said that automobile vehicles are to be used by the Pittsburgh Express Company, in connection with its trolley express cars. This company will do business on all the traction lines in the vicinity of Pittsburgh. It expects to operate eleven baggage cars and a large number of automobile delivery wagons. The baggage cars will have six-foot sliding doors on either side. The baggage can be taken up at any point along the line.

M. Berthelot has examined many classical specimens of ancient mirrors in different localities. They seem to have been made by blowing a thin-walled bulb of glass and pouring melted lead into a watch glass shaped portion of the thin bulb and manipulating it so as to spread the metal into a lining layer about one-tenth of a millimeter thick. The glass had to be made very thin, so as not to crack on contact with the melted lead.

Fifty acres of Adirondack burnt lands have been replanted this spring with white pine and other conifers by the New York State College of Forestry of Cornell University. Wood choppers were turned into expert tree planters, and at the same time a nursery has been established, with enough seed to furnish 3,000,000 seedlings, which when two years old will be set out and will be sufficient to cover 2,500 acres. It is expected that the college will plant at least 500 acres each year.

Brigadier-General Greely, Chief of the United States Signal Corps, has invited proposals for furnishing the army with three electric horseless carriages, and experiments will be carried out with them near Washington. Gen. Greely thinks it will be possible for these carriages to pay out wire promptly between two points so that telegraphic and telephonic communications can be readily opened. If the experiment is successful, carriages will be used for other purposes by the Signal Service.

Prof. Dewar has recently devised a new method of testing the contamination of air. A short time ago he exhibited before the Royal Institution two samples of liquid air in glass tubes; one was made from air which had been washed to purify it from dust, soot, carbonic acid and other impurities. This when condensed was a pale blue liquid; the other sample was made by condensing the air of the lecture room in which the audience was assembled and was an opaque, blackish fluid, resembling soup in appearance. It would appear as if condensed samples of air might afford an easy means for comparing different kinds of contamination. The American Architect suggests that it would not be difficult to provide a novel but a highly efficient kind of ventilation in military hospitals and other places where the natural air-supply is bad and the necessity for a better one very pressing. As the process would also cool and dry the air, it might serve an additional purpose in tropical countries. The paper goes on to state that it would not be "wholly impracticable to ship to yellow fever hospitals in Havana, supplies of New Hampshire air bottled, so to speak, on the spot, and delivered cool and fresh to the patients." This can never be accomplished, however, until some means have been provided for transporting liquid air to considerable distances without enormous losses, caused by its return to its former state. At present Mr. Tripler has not, we believe, carried liquid air more than six or seven hours' journey from New York. It has, we believe, been successfully carried to Boston and Washington from Mr. Tripler's laboratory in New York.

THE MANUFACTURE OF HIGH GRADE LINEN LEDGER PAPER.



a series of articles published in the SCIENTIFIC AMERICAN of March 19, April 30, and October 15, 1898, we described and illustrated the process of manufacturing paper from wood pulp. Paper of this kind is used for an endless variety of purposes which includes (mentioning them in the order of their quality,

and commencing with the cheapest) "wrapping paper;" cheap or "bogus manila;" for manufacture into bags; "best grade manila;" "news papers and hanging papers," and "book papers." These are made entirely from wood, spruce and poplar being the particular varieties employed.

The highest class of paper is known as "fine writing paper," and under this head is included note, bond, bank note, tracing, bank folio, and ledger paper. Much of this is made from a mixture of rag and wood fibers, while the very finest paper of all is made entirely from linen rags and some new cotton. The present article describes the process of manufacturing the finest grades of linen ledger and record paper as carried out at the mills of the Byron Weston Company, of Dalton, Mass., a concern which has been devoted exclusively to the manufacture of this article for the past thirty years.

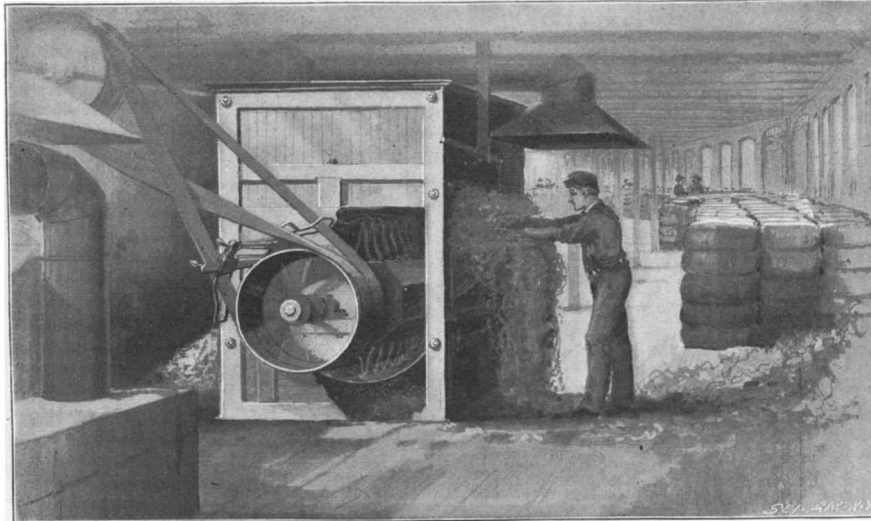
Before describing the manufacture in detail, it should be explained that in the production of these high grade papers it is necessary to secure great purity and cleanliness throughout the whole process, both in the materials and in their manipulation. Particular attention must be paid to the quality of the water, as in the case of the mills now under consideration, where, although good spring water is available, it was thought best to sink artesian wells and secure a supply entirely free from impurities due to surface drainage. As compared with the cheaper grades, ledger paper requires more time in its manufacture, the total time consumed from the sorting of the rags to the final packing of the finished sheets being six weeks, as against so many hours required in the preparation of the wood pulp papers. The features which are essential in ledger paper, mentioned in the order of their importance, are: 1st, strength; 2d, color; 3d, finish or surface; 4th, erasing and rewriting qualities; and 5th, ability to stand changes of climate without being sensibly affected. The subject of tests is mentioned at the close of this article.

The raw materials consist of new linen clippings from the factories of Belgium, England, Ireland, and France, new cotton from the shirt factories of the United States, and old linen, known as "Italian old linen," from Italy. The last named is thoroughly washed and disinfected and is sealed by the United States consul in Italy before it is shipped to this country. About 2,000,000 pounds of linen and cotton fabric is used up in these mills every year, the proportions being 1,300,000 pounds of high grade linen to 700,000 pounds of new cotton clippings. The cotton is introduced because it has been found by long experience that the proper combination of linen and cotton produces a paper superior to that made from all linen or all cotton.

THE THRASHING ROOM.—The material is first taken to the thrashing room, where it is placed in a closed box (Fig. 5), within which is a drum provided with a number of V-shaped iron beaters. Above the drum, and extending longitudinally above the drum, is fixed an iron bar, while below it is a curved iron screen. The drum rotates at a speed of 150 revolutions a minute, and by means of the beaters drives the dust through the screen into a dust-box and separates the good rags from the refuse. The refuse or "waste" is put through another thrasher and is then sold to the makers of certain cheaper grades of paper, while the "waste" from the second thrashing is sold to the makers of bag paper.

RAG ROOM.—From the thrashers the material is dropped into carts, wheeled to the elevators, and carried up to the rag room (Fig. 7), where from seventy to one hundred girls are engaged in carefully dressing and cutting the rags by hand to the required size, which in nearly all other mills is done by machinery, or a rag cutter. The operators do their work at two long tables which extend down each side of the room.

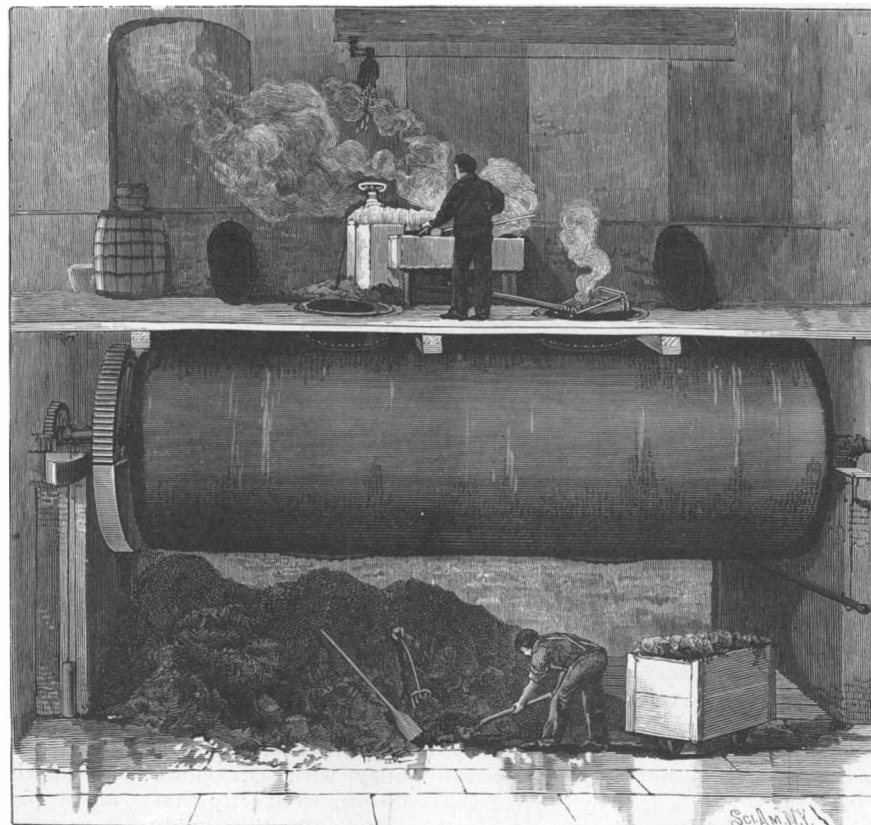
Standing before each girl, and affixed to the table, with its cutting edge facing the table, is a common scythe blade, as shown in the illustration. On the table is a wire screen. The dusted rags are thrown upon the screen, where they are carefully turned over and scrutinized. All foreign substances, such as jute or silk fabrics and all colored rags, are carefully removed. The latter would require chemical treatment, and it is the object of the company to use as little chemicals as possible in preparing the high grade of paper which they turn out, for the reason that such treatment would weaken the fiber and impair its lasting qualities. During the process of cutting, the girls cut the rags to the required size (about four inches in length, or the size of the palm of the hand) by drawing them, a handful



5.—Thrasher, for Cleaning the Rags.

at a time, down the scythes. The cut rags are thrown into baskets and then returned to the table for a second examination. There is a third inspection by the "overlookers," and the rags are finally looked over by the superintendent before being weighed and taken to the dusting room. Although the work done in the rag room might seem to be merely preliminary to the actual work of manufacture, it is actually of the first importance; for careless inspection would result in the introduction of poor or positively harmful material into the paper that would destroy its color, finish and durability.

DUSTING ROOM.—The dusting is done in a closed box in which is a rotating shaft, provided with a number of arms that are arranged spirally upon it, and serve to thoroughly beat the rags and carry away the dust and fine particles of fabric which they contain.



6.—Rotary Lime Boilers.

MANUFACTURE OF LINEN LEDGER PAPER.

In this operation the new and old linens and the cottons are mixed in the proper proportions. After they have been thoroughly cleaned they are ready for transportation from the "Rag Mill" to the "Making Mill."

ROTARY BLEACH.—The first operation in the making mill is that of bleaching. This is done in a large horizontal boiler (Fig. 6) about 6 feet in diameter and 25 feet long, which rotates on a pair of trunnions. The rags are dumped in through a couple of manholes, a

solution of lime is run in, live steam is admitted through the trunnions, and the whole mass is boiled, while rotating, for about twelve hours.

RAG ENGINE ROOM.—When the boiling is complete and the vegetable oil, grease, etc., have been thoroughly removed, the rotary bleach is stopped, manholes up, the covers are removed, and the rags are dumped onto the floor and removed in hand carts to the rag engine room. Here they are thoroughly washed with pure spring water, which is drawn from four artesian wells (see initial letter cut) that yield a supply of over 1,000 gallons a minute. The washing engines are similar in construction to the "engine beaters" described in the articles above mentioned on the manufacture of wood pulp. They consist of an oval tank about 3 feet deep,

on one side of which is a swiftly revolving drum, which carries on its periphery and parallel to its axis a series of iron blades. The lower half of the drum revolves in close proximity to a curved bed-plate, in which is fixed a series of blades similar to those on the drum. When the tank has been filled with rags and water, the drum is started and the mass is drawn in between the drum and the bed-plate and well drawn out, the friction and rubbing assisting the water in thoroughly cleansing the rags. The pulp slowly circulates round the tank and is again and again drawn in between the drum and the bed-plate, the operation continuing for a space of twelve hours. Fresh water is kept flowing into the tank at one point and the impure water is drawn off through strainers, which allow the water to pass, but hold the pulp. Just before the conclusion of the process a weak solution of chlorine is introduced into the tank. From the washers the pulp is next dropped

into a set of drainers (Fig. 3), large brick vaults 10 feet by 30 feet by 15 feet high, which are provided with floors of porous tile through which the water is allowed to drain away.

ENGINE BEATERS.—The bleached rags are now known as "half-stuff," for the reason that they are neither rags nor fiber, being only partially unraveled. In order to thoroughly separate the fibers, the "half-stuff," as soon as it is thoroughly drained, is taken out of the drainers and wheeled in carts to the engine-beaters, which are similar in construction to the washing engines already described, except that there are more knives in the bed-plate and roll. The material is manipulated in the engine-beaters for about eighteen hours; and in this operation great care is taken not to cut the fiber. To this end the knives are much blunter than those used in the wood pulp process, the object being to draw out the rags into fiber and preserve the valuable features of great length and strength of fiber which characterize this high grade linen ledger paper. To give a good color to the paper, a little blue (ultramarine) and red (cochineal) are added in the beaters, with a little resin to size the interior of the fiber and bind the fabric of the paper.

From the beaters the pulp is dropped through copper pipes to the "stuff chests"—large wooden tanks—in which it is mixed with water and agitated by long revolving arms, which reduce the water and fiber to the proper consistency.

MACHINE ROOM.—From the stuff chest the pulp is pumped up to the "machine room," where it is carefully screened, to take out all foreign matter in the way of hard substances, such as knots or matted fiber, and it is then run out into sheet form on the Fourdrinier machine (Fig. 1).

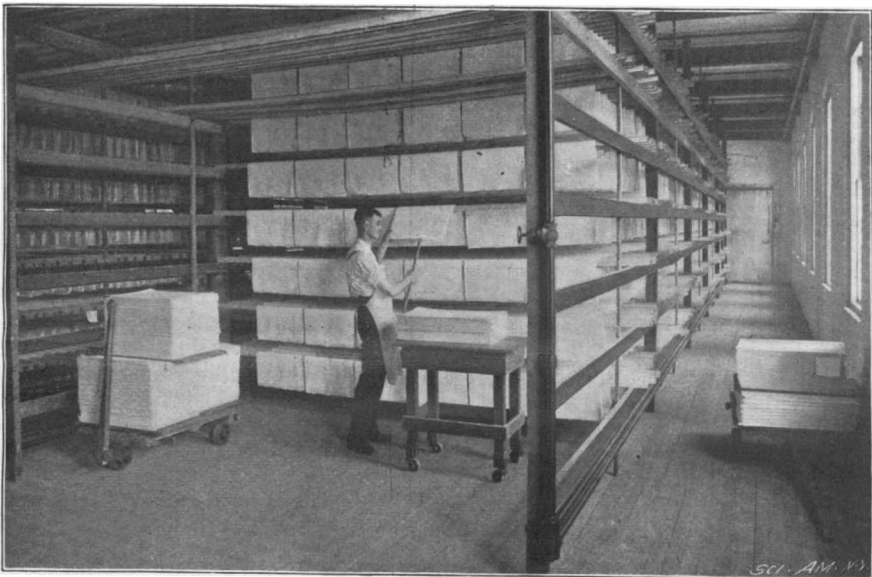
The pulp first passes into a "flow-box," from which it issues in a broad shallow stream or film onto an endless wire cloth, which has a slight inclination to assist the forward flow of the pulp. The cloth is about 70 inches wide, and the stream of pulp, which in appearance and consistency is not unlike watered milk, is kept from flowing over the edges of the cloth by two endless rubber guides or "deckle straps" which lie upon and travel with the cloth. In order to interlace the fibers, which are floating separately in the water, the wire cloth is given

a lateral oscillating or shaking motion, which entangles or interlocks the fibers much as the warp and woof of textile fabrics are interwoven in weaving. As the pulp flows forward, the water drains through the wire cloth, being assisted in this by suction boxes, which bear against the under side of the cloth, and are exhausted by suitable suction pumps. The wire with its layer of pulp now passes under the "dandy roll," which imprints the water mark while the mass is still soft, and then under two successive rolls which

squeeze out some of the moisture. The fiber is next caught up on an endless felt, and passes between a series of rollers which serve to squeeze out part of the remaining moisture. The sheet then begins to travel over and under seventeen successive rolls, at the end of which it is trimmed by having the "deckle-edge" cut off, is slit into sheets of the desired width, and is run through a bath of animal size.

The Byron Weston Company pay the greatest attention to the preparation of this size, as upon its quality and the care with which it is applied depend very largely the quality of the finished record paper. Upon the quality of the sizing depend the ruling qualities of the paper, its erasing qualities, its ability to stand changes of climate and temperature, and very largely its ability to stand continual handling without cracking. The animal size is prepared from rawhide shavings made from the hide of the East India buffalo. The rawhide, which comes to the mill in shredded form, is carefully washed in spring water and boiled at a low temperature, and the resultant liquid is drawn off into vats for further treatment by a secret process. The tank of size stands at the end of the drying cylinders, and after the paper is slit to the proper width, it is run down and through the size, and is then automatically cut to length and laid in piles by the "lay boy."

DRYING AND SEASONING LOFT.—It will be remembered that in the wood pulp process the paper is dried in passing through the steam-heated rolls of the Fourdrinier machine. In the linen ledger paper process, on the other hand, the paper comes from the machine damp with the size, and in order to allow the size to work thoroughly into the interior of the paper and to secure a better seasoning effect, the paper is allowed to dry by being hung in a loft, which is kept at an even temperature. The paper is hung up, four or five sheets



8.—Loft Drying.

together, in "spurs" on the loft poles (Fig. 8), and about fourteen days are allowed for seasoning.

FINISHING ROOM.—The sheets are next taken to the "jogging room," where they are straightened out and arranged in piles ready for the "finishing room," where they are placed in hydraulic presses and subjected to a pressure of 350 tons. They are left in the press for twelve hours and are then taken to the "calenders," which consist of three or four superimposed rolls, with surfaces made alternately of cotton and iron, between which the sheets are passed for the purpose of imparting the smooth finish characteristic of record paper. In this mill it is the object to secure a uniform finish on both sides which shall be smooth but without having any "greasy" appearance. The paper goes through the rolls five or six times, being passed through sometimes with the wrong and sometimes with the right side up.

Each sheet is then carefully inspected by girls, who hold it up to the light and look at it on both sides to detect any imperfections. Next follows an inspection by the foreman and finally by the superintendent, after which the sheets are counted and put up in reams of 480 sheets each. The edges are then trimmed exactly square, and the paper is tied up in reams and labeled for the market.

Every day specimens of the output are brought to the main office to be tested. The tests are made for writing, erasing and rewriting, finish and color, tensile strength and resistance to tearing. The tensile strength is tested on a special machine by clamping the sheet of paper over a 1¼-inch hole and subjecting it to pressure with a 1 inch piston and noting the load under which it gives way. Twenty-four pound folio must stand 75 pounds pressure, 28 pound demy, 90 pounds, and 40 pound medium, 100 pounds pressure. These pressures are almost exceeded before the paper gives way.

As an instance of the remarkable density of the paper and the thoroughness with which the sizing had penetrated its texture, we saw the numerals from 1 to 10 written and erased eight times in succession in the

same place on a piece of ledger paper without the ink running or spreading on the erased surface.

In concluding our description of this very complete plant, mention should be made of the motive power, which is illustrated on our front page engraving. It consists at both mills of two vertical Hercules turbines of 150 horse power each, running under a head of 23 feet, and a Corliss engine of 300 horse power. Both turbines and the Corliss engine are belted to a shaft which runs the entire length of the mill. A coupling on this shaft enables the company to use 150 or 300 or 600 horse power according as one or both turbines, or one turbine and the engine, or both turbines and the engine are coupled up.

The plant of the company includes two distinct mills, the Defiance and the Centennial. Each mill is complete in itself, and while the description of the process of manufacture above given refers to the Defiance Mill, it would apply equally well to the Centennial, which is the earlier structure of the two.

Some Interesting Inventions.

A barrel is a very awkward thing to handle, even with the trucks which are especially designed for carrying them. An Alabama inventor has devised a truck which consists of a pair of curved gripping jaws, somewhat resembling blacksmith's tongs. The levers operating the jaws form the handles of the truck. In practice the truck is run up to the barrel, and the jaws are clamped around the bottom. A clamp holds the lever arms firmly together until it is desired to release them for unshipping the barrel.

Hunters and campers who have used sleeping-bags find that they are comfortable and keep out wet and dampness, but a Canadian inventor has made what really seems to be a substantial improvement upon sleeping-bags. His invention consists of a rigid frame which is collapsible when not in use, and covered with some material intended to withstand the weather. The whole top can be thrown up by means of hinges. At the upper end of the lid is a small opening which is covered with a similar hinged lid. In cold weather this lid may be closed. In mild weather it may be fastened at any desired point. Ventilation is provided through holes under the projecting edge of the large flap.

One of the most perverse things in the world is a refrigerator cover. It is necessary to have the refrigerator stand well away from the wall in order that the cover may lie back against it when ice is being put into the refrigerator, or articles of food taken out. A Missouri inventor has devised a lid retainer for iceboxes, which permits of having the icebox pushed up against the wall and will hold the lid when it is thrown against the catch. It consists merely of a post extending upwardly from the rear part of the icebox and a detent pivoted to its upper end in such manner as to engage the forward edge of the box lid when it is thrown back.

A novelty is an electric fan worked on the principle of the nickel-in-the slot machine. When it is desired to operate the fan a nickel is dropped into a slot back of the fan, and a refreshing current of air is obtained until a certain predetermined amount of current has been used and the current is cut off. Many persons are deterred

from having electric fans owing to the considerable initial expense, and by the fact that they can be used only three or four months of the year. The inventor considers that fans would be more generally used if the breeze could be supplied by expending a small sum.



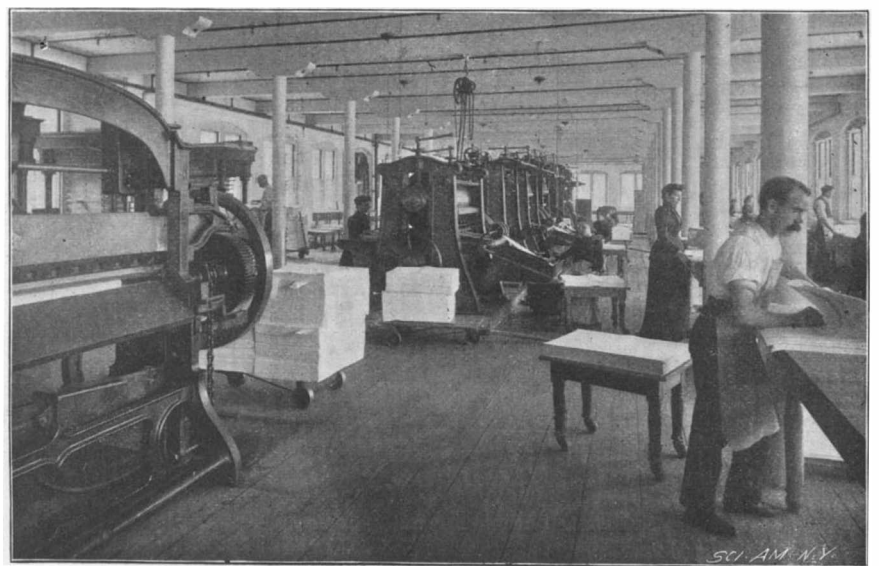
7.—Rag Room—Cutting and Assorting.

A Case of Triple Personality.

The Pathological Institute of the New York State Hospitals for the Insane (Boston Medical and Surgical Journal, February 23, 1899) has recently reported a case of great scientific interest occurring in the department of the institute devoted to psychology and psychopathology. The case is a remarkable one of amnesia, the patient being a clergyman about twenty-six years old, who fell out of a wagon, and, striking upon his head, became unconscious. When he recovered from the stupor, it was found that he had completely lost his memory and that his personality was lost with it. His mental condition was that of an infant, and in the course of education to which he was subjected he developed a new personality, totally different from the old. He next manifested the phenomena of alternating personality—for instance, falling asleep in his secondary personality and awakening in possession of his primitive personality, and vice versa. Neither personality was at all conscious of the other. The patient thus had two consciousnesses, which he possessed at different times, but between which there was absolutely no communication. The problem was how to unify this double consciousness. This was attempted by preventing him from lapsing into profound slumber, keeping him in a condition between sleeping and waking, and the result proved successful. As a consequence he developed a third personality, which was conscious of the other two personalities, and this finally filled every gap in his memory. Dr. Van Giesen, the director, speaks of the case with satisfaction, and expresses the opinion that it shows an advance in the domain of psychology.

A WRITER in Uhländ's Wochenschrift says: Perhaps the first industrial exposition on record was held in 1569 in the Rathhaus of Nuremberg. A catalogue published at the time thus states the purpose of the exposition: "It shall bring before the public all innovations in the trade of the whole world in modern times, together with domestic art-productions."

BRUGSCH BEY has lately described a comic papyrus which is unique. The artist lived in the period of the XXII. Dynasty, and has painted burlesque scenes in which cats and rats conduct themselves like human



9.—Finishing, Trimming, and Counting.

MANUFACTURE OF LINEN LEDGER PAPER.

beings. For instance, a rat attired as a great lady was served by a cat who is clothed as a slave and is presenting a mirror to the mistress.

Life in a Winter Bee Cellar.

BY GEORGE E. WALSH.

When the cold days of October and November chill the air to a freezing temperature, the honey bees go into their winter quarters, and enter upon their long period of hibernation. The mystery of the winter sleep which overtakes so many of our animals, insects, and reptiles is studied to the greatest advantage in a modern bee-cellar, where the little honey gatherers can be examined at leisure in the various stages of somnolence that so closely resembles death. In the last twenty years science has made such revolutions in apiculture that it is possible now to get a glimpse inside of a hive of bees at almost any time without disturbing its inmates.

With the instinct of self-protection the wild bees always built their homes in hollow trees or posts where they could huddle together for mutual warmth when autumn came, but in spite of this the mortality was so great among them that their numbers did not increase rapidly. Some winters they were slain by the thousands and whole swarms would be frozen to death. The farmers who first attempted to cultivate the acquaintance of the bees for the honey they could induce them to raise always expected to lose more than half their colonies in particularly severe winters.

In the North the apiarists generally have large bee-cellars where the little insects are kept through the cold winter months. These cellars are models of sanitary construction, for in its artificial home the honey bee is very susceptible to little diseases that never bothered it in its wild state.

The bee-cellars are constructed so that perfect drainage is obtained, for moisture in a bee-cellar means death to its inmates. Then some simple but effective ventilation system is adopted. The temperature of the cellar must be kept low, just above the freezing point, throughout the winter months. Heat is supplied for very cold weather by hot air or an ordinary stove. A thermometer is always kept in the cellar to see that an even temperature is maintained.

In this cellar the bees are brought from their summer stands as soon as the weather is cool enough to warrant the change. The summer hives are carted to the cellar, and one piled upon another in tiers reaching to the roof. Between each tier there is a small space to permit the owner to reach any particular hive, and between each hive a strip of wood is placed to separate them sufficiently to allow a free circulation of air. It is quite a question of science sometimes to keep the right temperature for all the bees, because the outer hives must of necessity be exposed to cold draughts more than those inside, but the apiarist is supposed to overcome this difficulty by the peculiar arrangement of his heating apparatus, and by additional protection for some of the exposed hives in the shape of a straw covering. A current of cold air is sometimes artificially forced through the cellar.

The temperature of the cellar is so low that the bees are in a semi-hibernating condition all winter. It would not be profitable to the apiarist to raise it so that they would be stirring around, for bees, like all other hibernating creatures, are very hungry when they wake up from their long sleep. In the midwinter thaw, which nearly always visits us in January or February, the weather often becomes so mild that the bees wake up of their own accord, and show a decided propensity to fly about. They imagine that spring has arrived again, and if they have the chance, they fly about. The owner does not discourage this desire for exercise, but approves of it, and gives the insects all possible encouragement. A little flight in the middle of the day gives them fresh air, and enables them to void their intestines, which reduces their chance of serious diseases.

But in this midwinter flight many of the bees sometimes get lost, or, becoming chilled and benumbed, in their return trip to the cellar they drop down in the grass and die. Thus in bee-keeping districts it is not at all uncommon to find bees crawling about in the grass in the middle of winter. It may be concluded for certain that they are from some neighboring hive from which they have strayed too far. Frequently the bees fly about in all directions, apparently looking for flowers, but, not finding any, they return to the hive without having once lighted. It is probable that they have become so disgusted with the country that produces no flowers with nectar in their chalices that they prefer to return to their warm hive, where at least food can be found.

This food given to the bees in the winter is not as desirable as honey. It is generally compounded of cheap glucose, sugar, and water. The bees do not even like pure sugar as well as honey, but they will eat it in the absence of their favorite nectar. Considerable of this food has to be given to the bees in their winter quarters. It is put in the artificial comb, and artificially capped where the bees can reach it when they require it. If this food should give out unexpectedly in the winter, the bees would quickly starve to death unless it were replaced.

The bees cluster together in the hives in their winter quarters like bats hibernating in a cave. They

cling so closely together that they look like a big mass of inanimate insects. Occasionally a leg or wing will move to show that they are alive. Those in the center of this swarm are kept very warm by the heat imparted to them from the bodies of the others, and they are frequently the liveliest of the whole lot. They will wriggle and squirm around sometimes so that the whole mass will vibrate. It would seem as if their sleep was a little restless, rendered so probably by a too high temperature.

The bees on the outside of the mass are so far gone in their slumbers that they can be picked up with impunity and examined. There will be no attempt to sting the hand that lifts them unless the warmth from it furnishes them with new life. Their hibernating period ends just as soon as spring begins to warm the air, and then they grow restless and anxious to get out of their winter quarters.

The first consideration is to see if the queen is all right in each hive. Sometimes it is difficult to find the queen in the midst of the newly awakening horde of insects, but it is an easy matter to discover signs which indicate her presence. For instance, if the brood and eggs are numerous and in good condition, he knows that the queen has successfully performed her duty; but if there are no eggs and sealed grubs visible, the colony is in a critical condition, and something must be done very soon. The modern hive with its movable frames and artificial combs enables the apiarist to act quickly, so that a queenless colony may sometimes be strengthened. Going to a colony with a queen and plenty of brood, the apiarist takes out one of the movable frames of brood, and puts it in the hive without a queen. This soon works magic results. The few surviving members of the depleted colony take it upon themselves to hatch out the new brood, with the hope that a new queen can be raised by them. The loss of a queen is so discouraging to a colony of bees that the little insects will lose all ambition, especially in cold weather. In the summer time a queenless colony can receive a new queen by the introduction of a new one by means of the artificial queen cage.

All of the modern devices and improvements in bee culture help to simplify an industry that has taken rapid forward strides in the past quarter of a century.

There is as much science in apiculture to-day as there is in tilling the soil for intensive farming. The bee-keeper is supplied with almost as many implements as the farmer. The hive itself is a wonderful piece of mechanism. The Langstroth hive, ingeniously devised and patented by Dr. Langstroth about thirty years ago, is the foundation for all of the modern hives, which are simply modifications of the original. These hives are manufactured by machinery, and they are so cut and arranged that they can be shipped in sections to any part of the country, at little cost, and then be put together by a boy. They are usually sold in lots of a dozen or more, with the sections cut in single pieces of wood, grooved and creased, so they can be bent around and locked as easily as one would put a picture puzzle together.

The Langstroth hive and frame created the first and probably the greatest revolution in bee-keeping. The movable frame is a device by which the inside of the hive can be removed by sections, and without disturbing the bees in other parts of the hive. Thus the comb honey in one section can be removed, while the bees are scarcely aware of it. The next greatest invention was the centrifugal honey extractor. This extractor enables the apiarist to take from the natural honey comb all of the honey without disturbing or breaking the comb. Then the bees proceed to fill it again with a new crop of honey. Thus the apiarist keeps stimulating the bees to greater effort to fill the combs before the season is over. The comb foundation was another great invention. This foundation saves the bees many hours of work. Broken, dirty, and brood comb can be taken and placed in the hive by means of the comb foundation, so that the bees will make a full one much quicker than if they had to lay the foundations of an entirely new one. The modern method of introducing Italian queen bees in the hives is probably fully as important in its results as some of the foregoing inventions, and it should be classed high among the factors that have brought larger profits to the apiarists in all parts of the country.

The Electricity Building at the Paris Exposition.

The building which will be devoted to the electrical exhibits of the Paris Exposition will be a most remarkable structure. It is so florid and ornate that it resembles no other building ever constructed. It will undoubtedly be the most striking building which is seen on entering the grounds. The façade has a richly ornamented portico, and directly in the middle is an enormous fountain which masks three-quarters of the central part of the facade. It is what is known as a "Chateau d'Eaux," and consists of a deep niche with steps at various levels over which water will flow, and a group of sculpture will terminate it. The building will be made of staff and will be brilliantly treated in color.

Archæological News and Notes.

The great glory of Chesterfield House, London, is a marble staircase, each step of which is formed of a single block of marble more than twenty feet long.

The death is announced of Mr. Charles Edward Drury-Fortnum, who is well known as an antiquarian. In 1888 he presented his splendid collection of plaster and Renaissance art objects to the University of Oxford. He was a great authority on gems, bronzes, and majolica.

An important work is soon to be begun at Spalato, in Dalmatia. This will be the building of a central museum in which the collection at present scattered among four buildings will be brought together, including the objects found at Salona and in the Palace of Diocletian.

The English archæologist, Mr. Phillips, has offered Signor Baccelli, the Italian Minister of Public Instruction, the sum of \$12,500 for the carrying out of investigations in the Forum. The money will be largely used in expropriating the houses now standing about the ruins of the Basilica.

The plan for reviving the business in the Palais Royal at Paris is under consideration. If this is done, the quiet of the garden in the center of the buildings will be destroyed and it will be turned into a thoroughfare between the great boulevards and the quarter of the Louvre, thus sweeping away one of the oldest landmarks in Paris.

The architect, M. Redon, who has charge of the Louvre, has resolved to restore the Tuileries Garden to the condition in which it was in the days of La Nôtre. As the palace does not exist to-day, it is impossible to say whether the old artificial style will be more pleasing or not. It is an interesting experiment, however, and well worth trying.

Heinrich Kiepert, probably the greatest authority on the geography of antiquity, recently died at the age of eighty-one years. He was professor at the University of Berlin. His "Atlas of Hellas" began to appear in 1840. His greatest work is his "Map of Asia Minor." He also published a general atlas of the world, which is one of the best modern German atlases.

It is proposed to erect a statue at Vendome, in Touraine, France, of Marshal de Rochambeau, who commanded the French forces serving in the American Revolutionary war. The Historical Society of Philadelphia has subscribed \$1,000. It is hoped and proposed that Philadelphia, Boston, and New York each will subscribe \$1,000, and that a like sum be raised in France by subscription.

In Paris, May 1 is supposed to be inaugurated by the discharge of the cannon in the Palais Royal, the powder being ignited by the sun. This year, however, the function was delayed several days owing to bad weather. The cannon is of considerable historical importance. According to The English Architect, it was presented in 1786 by Rousseau and was well known to Camille Desmoulins.

Dr. Ernest Steinmann, the well known art writer, has just made some interesting discoveries in the Vatican. The Stanze of the Vatican contain the wonderful frescoes executed by Raphael and by his pupils. Before the great master had demonstrated his wonderful ability by painting the School of Athens, some of the other artists attempted to paint the walls. Remnants of these early paintings have now come to light. They are of no great importance in the history of art, but they suggest that the whole of the walls of the Stanze were covered with a series of paintings which may have helped Raphael or rather given him ideas of the great work which followed. There is considerable conjecture as to this however, as Raphael was too much of an originator to be very much helped by the work of inferior men, although he did not hesitate to assimilate the ideas of the masters of all time.

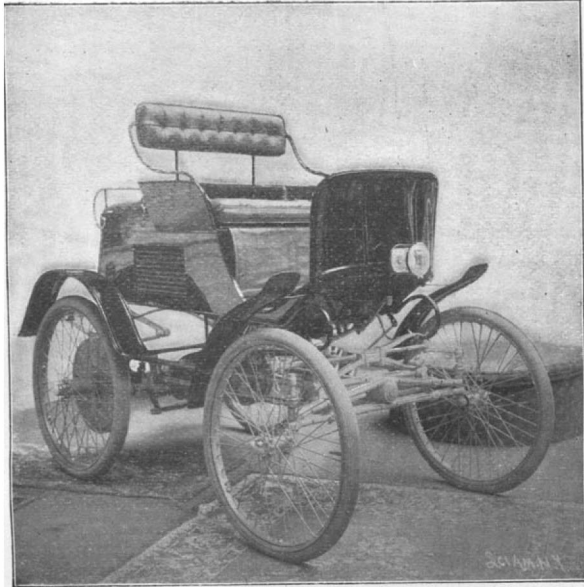
Students of architecture may have often wondered how the two towers of Nôtre Dame, at Paris, were not of the same size. A writer in one of the English magazines has found a rather curious explanation. It appears that when the cathedral was built it was the cathedral of a suffragan bishop, who was not entitled to two towers of equal height, and for centuries the Bishop of Paris was suffragan to the Bishop of Sens.

Explorations are proceeding rapidly in the Forum, Rome, and following upon the expropriation of the site of the Basilica Æmelia comes the good news that the ugly seventeenth century church of San Lorenzo, in Miranda, which has disfigured the beautiful temple of Antoninus and Faustina, is to be taken away, so that the remains of this imposing temple will now be revealed in all their beauty. The columns are the largest of their kind in Rome, being fifty feet high and ten in number. The three large steps of the portico which descend to the Via Sacra have now been entirely cleared of rubbish, so that not only is the majestic flight of steps which led up to the temple actually seen for the first time for at least fourteen centuries, but the actual width of the Via Sacra in front of it is likewise for the first time actually made known.

WAVERLY ELECTRIC RUNABOUT AND COLUMBIA ELECTRIC EMERGENCY WAGON.

At the Electrical Exhibition just closed at Madison Square Garden, there were shown several neat-looking electric vehicles by the Indiana Bicycle Company. Among them is an electric runabout designed mainly for two persons, but finished at the back, over the rear extension of the body, with cushions for seating one or two others, intended as an emergency seat. Such construction avoids the over-heavy appearance sometimes noticed in other similar vehicles.

As will be seen in the illustrations, one showing a



THE WAVERLY RUNABOUT.

front and the other a rear view, the framework and running gear is somewhat peculiar, built of steel bicycle tubing on what is called the bridge or truss plan.

The front portion of this double tubing is bolted to the front truss-shaped axle and permits the body to tilt slightly when the vehicle is on a side hill. At each end of the trussed axle are vertical crooked axles bending outward horizontally at their lower ends on which the front wheels run, and connected at the upper ends with the steering rod, which rises through the front part of the carriage, where it is jointed so that the handle may be in a horizontal position. In the rear view it will be observed that the method of applying the power is from a single motor shaft by pinions meshing into two large gear wheels on the main axle covered with metal casing. The motor shaft is hollow and runs through the center of the armature of the motor, and contains within itself differential gear for allowing one wheel to turn faster than the other. The brake band is applied to this motor shaft in a very simple way, and is operated by a small foot lever located near the dashboard.

The controller is under the front seat, and the operating lever is on the left hand side. This is arranged with a movable press button on the end, which, when pressed inward, enables the current to be reversed for backing the vehicle. In addition to the controller there are one or two small resistance coils attached to the underside of the bottom for equalizing the sudden application of the current in starting or in changing the speed.

The storage battery employed is of special construction, made by the company, and yields a good percentage of current put into it. In this vehicle it weighs 500 pounds and has a capacity sufficient to run the vehicle a distance of about 30 miles on a fairly level road. The motor yields 1½ horse power under ordinary circumstances, but will give more when pushed. An electric dash lamp is on the front. This style of vehicle is quite popular in the West and contains the elements of strength, lightness, economy, and capacity.

The large illustration shows a new style of an electric emergency wagon exhibited by the Columbia Automobile Company (formerly the Pope Electric Vehicle Company), built for the Consolidated Traction Company, of Pittsburg, Pa. This vehicle is designed as

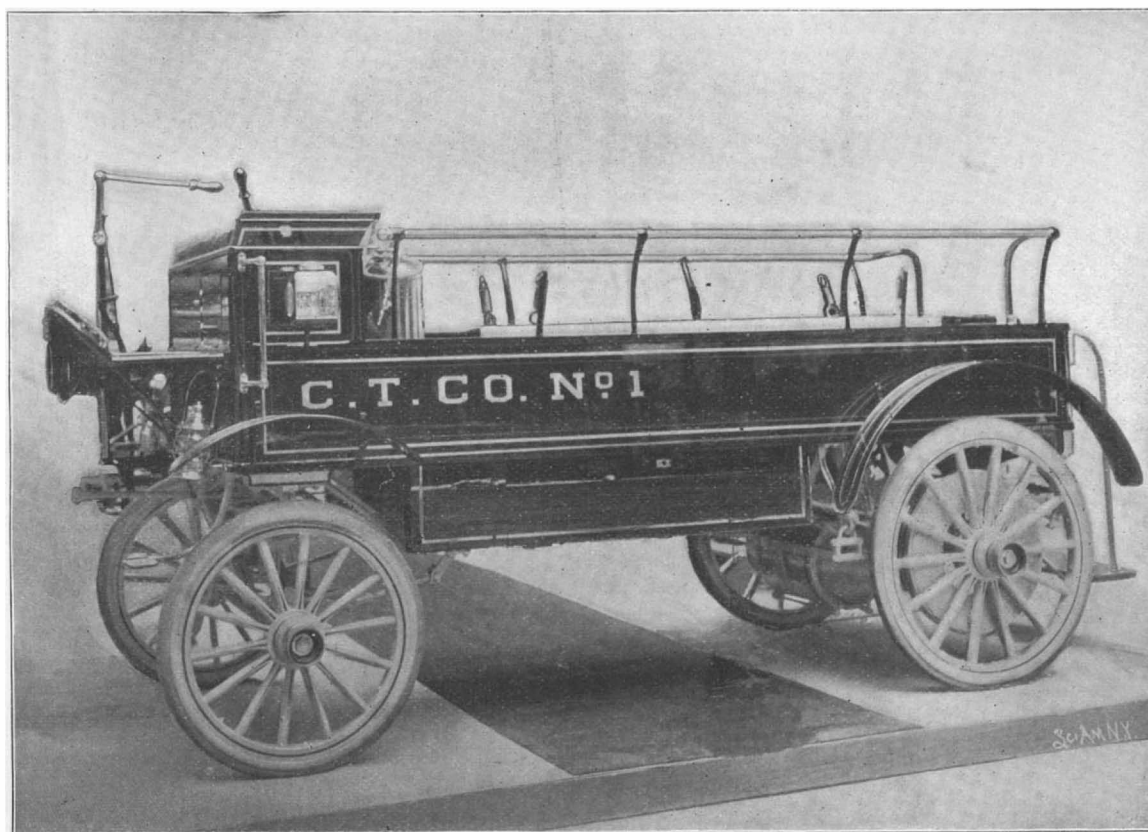
an emergency and repair wagon for street railway service, carrying a crew of four or five men at a speed of ten miles per hour for eighteen miles, this distance, however, being much in excess of the requirements in this particular class of work. It carries a full equipment of all appliances and tools ordinarily required on wagons of this type—fire extinguishers, extension ladders, stretcher, lanterns, and a complete kit of linemen's tools and apparatus. The illustration shows the stretcher hung on springs over the aisle space. The batteries, of the chloride type, weigh 1,400 lbs., and are carried in trays beneath the main body, and are removable at the side. The total weight is 4,500 lbs. Wooden wheels, 42 inches in diameter at the rear and 36 inches at the front, with solid tires, are used.

An interesting feature of the running gear of this vehicle is that no reach connection between the front and rear axles is employed. The place of the reach is taken by a combination of pieces, forming a truss which reaches from the front axle backward and upward against the body, bracing it against direct head-on strains. A single reduction of gearing is used on this wagon. The entire driving mechanism, motor, balance gear, and driving shafts, forms a compact unit which is rigidly held in alignment by the rear axle and rear cross tube. A 5 horse power Westinghouse motor is used. The motor frame is enveloped in a water and dust proof casing covering all parts except the driving pinions, which have a separate housing. The steering lever is mounted just back of the dashboard and operates the front wheels parallel together in the usual way. On the left is the controller lever, and behind the seat will be noticed a fire extinguisher. The body is finished with Tuscan red, black mouldings, gold stripe edged, with fine line of black, fine line of yellow surrounding panels an inch from gold line. The running gear is yellow with black stripe. The wagon can be turned around in 40 feet, which is a comparatively small circle, considering the dimensions, which are width over all 6 feet, length over all 15 feet, height 6 feet 7 inches.

It will evidently be much more economical for trolley companies, having a constant supply of electricity at hand, to possess a vehicle of this character than to maintain a team of horses. It would also be a useful vehicle for small towns to possess where it is desired to establish fire service.

Manufacture of Marmalade in Scotland.

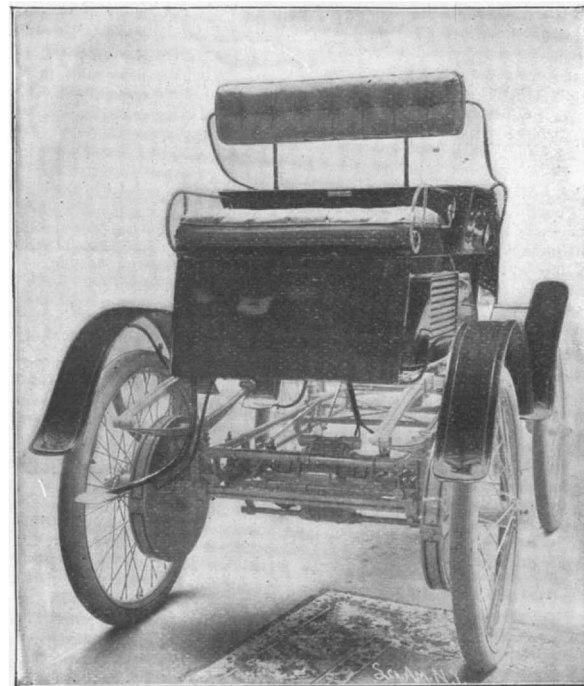
In reply to inquiries by a California company, Consul Higgins, of Dundee, says: The manufacture of marmalade forms a considerable industry in this city. It is made in two kinds, known to the trade as "mar-



AN ELECTRIC EMERGENCY AND REPAIR WAGON.

malade" and "home-made marmalade." In the former case, all the white substance adhering to the skin is retained, while in the quality known as "home-made" this is carefully removed and the outer skin but sparingly used, giving the preserve the appearance of a jelly. The skins are cut in quarters by hand, and par-boiled in barrels arranged in a line and having a steam pipe running along the top, from which branches pass down the center of the barrels. Seeds and fibrous matter are removed by machinery. Bitter oranges only are used, and come from Spain. In the best qualities, pure sugar is used; in the cheaper varieties, inferior sugar mixed with glucose in a proportion varying from 3½ to 7 pounds for every 100 pounds of sugar. The cost of a 15 horse power boiler is \$973. This will supply heat

to six pans, from which 5 or 6 tons a day can be turned out. Jam-boiling pans of 60 pounds pressure cost \$67; of 90 and 120 pounds pressure, \$76 and \$85, respectively. These are of the same size, the additional cost being due to the heavier copper for the high pressure. A small horizontal engine with governor costs \$171; chipping machine for skins, \$124; pulping machine, \$110; machine for "home-made" marmalade, \$124; shafting,



MOTOR AND DRIVING GEAR OF THE WAVERLY ELECTRIC RUNABOUT.

hangers, and drums, \$42. These prices are on board steamer at Dundee.

The June Building Edition.

The SCIENTIFIC AMERICAN Building Edition for June is an unusually attractive number of this interesting periodical. A fine Colonial house at Holyoke, Mass., is the subject of the colored cover. The new Hudson Park in New York city occupies the first page; then follows a selection of houses and churches, accompanied by interior views and plans. The restored Independence Hall, at Philadelphia, makes an excellent page. The literary contents of the number are up to the standard.

The Current Supplement.

The current SUPPLEMENT, No. 1223, has many articles of unusual interest. The front page is taken up by six handsome engravings of "Scenes in Matanzas." The "Relation of External Agents in Plant Reproduction" is a lecture by Stewardson Brown. "Earth Worms" is an article by M. C. Holmes. "The Wehnelt Interrupter for Induction Coils" describes an interesting form of apparatus. "A Thousand Days in the Arctic" is a review of Frederick G. Jackson's experiences in the Arctic regions as leader of the Jackson-Harnsworth expedition. The passage relating to the meeting of Nansen is given in full. Among the other articles are "The Commercial Development of Germany;" "The Progress of Submarine Navigation," with 18 illustrations; "Rapid Blue Print Processes;" "The 'House in the Woods' at

The Hague;" and "Enameling as an Industry," complete this very interesting paper.

Contents.

(Illustrated articles are marked with an asterisk.)

Allegheny Observatory, director of.....	375	Literature, emotional curve of.....	375
Archaeological news and notes.....	380	Marmalade, manufacture of.....	381
Bee cellar.....	380	Metal, electrolytic cleaning of.....	374
Building edition.....	381	Notes and queries.....	383
Cabinet for filing documents*.....	374	Notes and receipts, miscellaneous.....	377
Cable to Iceland and Greenland.....	377	Paper, manufacture of ledger*.....	378
Carriages, electric*.....	381	Paris Exposition, electricity building of.....	380
Discovery, Tower of London.....	374	Polar expedition.....	375
Drainage, tide and wave.....	377	Press, hydraulic*.....	374
Emergency wagon*.....	381	Science notes.....	377
Expedition, Fish Commission.....	374	Sodium sulphite.....	375
Feed water heater*.....	375	Stereopticon, new form of*.....	374
Fossils, how preserved.....	376	Supplement, current.....	381
Inventions, index of.....	382	Triple personality.....	379
Inventions recently patented.....	388	Wave action, philosophy of explosive*.....	376
Inventions, some interesting.....	379		
Leaves, adaptation of.....	377		

RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

ELECTRIC ARC LAMP.—PAUL MERSCH, Paris, France. Solenoid-coils are employed having cores movable therein, with which one carbon-holder is directly connected. The other carbon-holder is so connected with the first holder that it moves in a direction opposite thereto. The solenoid-coils are electrically connected in parallel with each other and with the carbons. As the carbons wear away, a steadily-increasing main current will pass through the solenoids until their magnetic effect becomes sufficiently powerful gradually to attract the cores, which will, accordingly, transmit their motion to the carbon-holders so as to bring them nearer together, this movement of the holders being never more than necessary to take up the wear of the carbons.

TELEPHONE-TRANSMITTER.—JAMES H. SPENCER, Manhattan, New York city. The transmitter comprises a disk which is slightly dishd on both faces and which is of considerable thickness, so as to be but slightly flexible. Clamps are provided, which are curved to bear only on two points of the disk. A button is carried by the disk and another by the transmitter-frame. By holding the disk securely and by connecting one of the buttons rigidly with the disk, sufficient vibration is given to the button readily to transmit sounds to the receiver. By forming the transmitter with a heavy disk the instrument is rendered more durable.

Mechanical Devices.

SUGAR-CUTTING MACHINE.—GUSTAV STOFF, Berlin, Germany. This invention provides a machine which automatically cuts rods of candied sugar into pieces of certain lengths, the rods being fed by spring-pressed rollers to a pair of rotating cutters, each having blades arranged tangentially in order to cut the rods into pieces. The inventor has endeavored to provide means for regulating the pressure of the feed-rollers at pleasure by providing universal joints between the top feed-roller and its driving-shaft, and by providing a chute by which the stump, or last piece of sugar rod, may be separated from the cut pieces.

SCREENING-MACHINE.—JOSEPH M. ELDER and OLIVER W. DUNLAP, Bloomington, Ill. The machine devised by these inventors is especially designed for screening the moist and sticky clay used in the manufacture of bricks. In an inclined frame an endless screen is mounted, which is composed of pivoted sections, and which has motion in an upward direction. A discharge-chute is arranged between the runs of the screen and has its lower end terminating adjacent to the lower screen-carrying wheels, whereby the refined material is discharged between the sections of the screen.

MACHINE-DRILL SHARPENER.—JAMES J. BROS-SORT, Butte, Mont. The sharpener comprises an anvil reciprocated by a hammer provided with swages for the flanges of the drill-shank. A cam-arm is adapted to engage the top edge of the hammer to lock the hammer in place so that the flange-swages are caused to clamp the drill. A reciprocating end swage at an angle to the other swages is adapted to operate on the end of the drill. By means of this device one workman can sharpen a large number of drills in a very short time.

Miscellaneous Inventions.

MINING-HAMMER.—FREDERICK R. WATERS, Ouray, Col. To construct the head of a hammer so that it can be used for removing as well as driving a drill is the purpose of the present invention. To this end the hammer-head is provided with a central transverse groove extending across its outer side and adapted to fit upon or receive the body of the drill.

TURBINE WATER-WHEEL.—JOHN SHARPE, Gravenhurst, Ontario, Canada. Leading to a tank are two flumes, each carrying and communicating with a casing. Gates command the flumes, which are respectively movable into the casing to open the flumes. A stem connected with each gate passes through a guide-bar extending between the casings. A lift is used in connection with the stems of the gates, and is raised and lowered by mechanism to operate the gates.

FLOUR-BOLT.—JOHN CHARLES, Charlton, Md. This invention provides improvements whereby the gyratory movements of the superposed sieve-boxes, may be caused to compensate one for the other to avoid the jar which would otherwise result, and also to reduce to a minimum the wear on the eccentrics and shafts and their bearings. The invention, although primarily useful in flour-bolts, is also serviceable in scalpers, graders, separators, and like machines.

HOT BLAST BOX.—SIDNEY E. BRETHERTON, Silver City, New Mexico. By means of this invention the waste heat of slag can be utilized for smelting purposes. The box is horizontally mounted in the upper part of inclosing walls, and has a longitudinal partition, with inlet and outlet openings. A series of vertical tubes extend through the compartments, open through the top and bottom walls of the box, and constitute draft-passages for the hot currents from the subjacent slag. The inventor claims that by means of his device a larger furnace-capacity is obtained, that tuyeres keep open better, and that the slag derived from the matte is exceedingly clean and free from values.

DEVICE FOR FASTENING CURTAINS TO VEHICLE-TOPS.—NELS J. BOTTGGER, Clyde, Kan. This device consists essentially of a peculiarly-formed clasp and buckle which, when locked together, cannot accidentally become disconnected, but which however, can be readily locked and unlocked. The latch consists of a skeleton frame formed with spurs, a tongue projecting from the upper central portion, and a lip projecting from its lower portion. An auxiliary tongue is secured to the frame in the rear of the first-named tongue. A back-plate is provided upon which the spurs of the body are bent after having been passed through the curtains. The auxiliary tongue serves the purpose of preventing the curtain from becoming accidentally disconnected from the top of the vehicle.

MOLD FOR PISTON-PACKING.—FREDERICK VAN DEN BOSCH, Parker's Landing, Penn. This inventor has already received letters patent for a piston-cup or packing-ring composed in part of vulcanizable material, the cup or ring being particularly adapted for such pistons as are commonly used in deep wells, and, there-

fore, subjected to great strain or wear. The present invention comprises improvements in the mold and in the means for temporarily clamping its detachable parts together, as required for imparting the desired shape to the cup or ring and holding it duly confined while being vulcanized.

FRUIT OR VEGETABLE PRESS.—JULIA A. WARE, Salida, Col. The object of this invention is to provide a vessel or receptacle in which fruit or vegetables may be cooked, and to provide means whereby the vessel or receptacle may be utilized as a press or a strainer for potatoes or other vegetables, or for making wines or jellies. The device comprises a vessel in which a strainer is supported. In the strainer a hollow plunger moves. From side to side of the plunger a cross-bar extends with which a rod is connected having a lever for operating the plunger.

TOY.—NAPOLEON E. BEAUDOIN, Jersey City, N. J. This toy consists of a pan, in the center of which a post is adjustably mounted, which post is adapted to receive a base block upon which a United States flag is secured. By dextrously jolting the pan, the player strives to throw the base-block and attachments thereon upwardly, so as to lodge the base-block on the post—a feat which requires no little adroitness.

LOCK FOR PRINTERS' GALLEYS.—WILLIAM C. BARNES, 1733 Q Street, Washington, D. C. The lock comprises a foot and a side locking stick, or member so constructed and applied to the galley that it may be quickly adjusted to any point between the side surfaces. The foot-member has adjustable and clamping engagement with the side member and is adapted to engage with the foot of the matter set up and with the side of the galley. A clamp is provided for the two members which may be readily tightened up or loosened.

BUTTER SHREDDER.—VALLIE G. TICE, Spring Creek, Penn. To mold butter which has been in cold storage requires an increase in temperature, which often injures the quality and the flavor. The object of the present invention is to provide a device which prepares the butter so that it may be worked into prints without raising the temperature. The mechanism used for this purpose comprises a rotating disk having radial slots and one or more toothed knives upon which the butter is placed and upon which it is shredded by the rotation of the disk.

PERMUTATION-LOCK FOR TOY SAFES.—CHARLES ROSSIGNOL, Paris, France. The lock consists of a bolt supported in the door and lock-casing and carrying screw-threaded knobs, which operate ratchets having screw-threaded shanks and notched bosses. Springs used in connection with tongues are adapted to prevent a retraction of the bolt, unless the notches register with the tongues. Lettered disks are employed to indicate the correct position of each notch.

SURVEYOR'S PLUMB-BOB.—ISAAC A. MARTIN, Ouray, Col. The novel features of this invention are found in the means provided for drawing up the suspending-cord within the bob. The means in question consist of a spring-operated reel controlled by a system of gearing. In using plumb-bobs in surveying, it is often necessary to shorten or lengthen the suspending-cord quickly. By means of a device of the character described, this result can be attained.

EXTENSION-TABLE.—JOHN T. LA TURNO, Grand Tower, Ill. The table comprises two separable sections. Arms are pivoted to swing in the arc of a circle at the central portion of the table and carry extension-leaves rigid with the arms so as to be capable of moving from an inclined position to a horizontal position. Inclined projections carried by the table-sections are arranged successively to raise the extension-leaves as the sections are moved apart. Any desired number of auxiliary leaves can thus be automatically and successively placed in position upon drawing the table-sections to the desired length of extension.

LACE-FASTENER.—ANNA HANSON, Jackson, Mich. To provide a fastening device especially adapted for use in connection with shoe-laces, which device will be independent of the lace and the shoe to which it is applied, is the purpose of the present invention. The fastener has two sections hinged together, one of the sections having a cavity and recesses in its opposite sides. Through these recesses the bows of the lace may be passed. The other section has a slot adapted to receive the standing parts of the laces. A catch removably holds the sections engaged with each other.

BEDSTEAD-FASTENING.—FRANK A. HALL, Montclair, N. J., and EDWARD F. TILLEY, Brooklyn, New York city. This invention relates to bedstead-fasteners in which the side rails of the frame are joined to the posts by means of coacting hooks and pins, and in which the fastening is made rigid and unbreakable by constructing the two parts so that there is produced between them a binding action in addition to the connection of the hooks and pins.

LOTION.—CHARLES E. GRAPEWINE, San Diego, Cal. This lotion, for use upon the skin, is of a semifluid or cream-like consistence, and consists of cooked and defibrated lemon and salt, the proportions used being one-half pound of salt to one gallon of the lemon ingredient. The lotion is produced from the oil, the starchy substance of the pulp, rind, and seed, and the juice contained in the lemon, these ingredients being thoroughly mixed and cooked with the addition of salt.

Designs.

PLOW-UPRIGHT.—HENRY H. STRAUGHAN, Dillon, S. C. The upright has a base from the rear end of which rises vertically a wing, the upper end of which terminates in a threaded tenon. Another wing rises from the front end of the base-wing and is bent back, then forward, and finally down.

TOOL.—WILLIAM W. BROWNELL, Lake Placid, N. Y. This tool is a hammer having two sets of claws, one in front of the other. The claws are adapted successively to engage the nail to be drawn, thus giving two degrees of leverage.

CLOTHES-FORK.—JOHN A. OLSON, La Grange, Ill. The fork consists of two pieces of spring wood fastened together at one end. The fork prevents the scalding of the hands in removing clothes from wash-boliers.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Order White Metal & Brass Pattern Letters & Figures of H. W. Knight & Son, Seneca Falls, N. Y. Drawer 1115. Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free. Gasoline Brazing Forge, Turner Brass Works, Chicago. Yankee Notions. Waterbury Button Co., Waterbury, Ct.

Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 141 Varick St., N. Y.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, \$4. Munn & Co., publishers, 361 Broadway, N. Y.

Patent for Sale—Combined Thimble, Thread Cutter, Needle Holder. Hirschfeld, care Occidental Hotel, 148 Bowery, New York.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question. **Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price. **Minerals** sent for examination should be distinctly marked or labeled.

(7670) H. H. G. writes: I wish to show the number of people in a room. This room is only lit up by gas light. It is not necessary to show the features or other portions of their anatomy. A dark spot on the picture will suffice. Can this be done by photography, and how long an exposure is necessary? Can it be done by gas light? A. Of course a photograph can be taken which will show the number of people in a room unless some are behind others. An exposure of 4 to 10 minutes by gas light will probably be necessary to do this. The time necessary depends on the brightness of the gas. Why not try a flash light?

(7671) H. K. says: Will you kindly give us through your columns the formula of a solution for coloring steel both brown and blue, to give it the same appearance as is given to gun barrels? A. We recommend you to purchase a copy of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 830, which contains an article entitled "Gun Wrinkles," which deals with the blacking, browning and bluing of gun barrels.

(7672) H. S. asks: Will you kindly answer in Notes and Queries the following questions concerning the high frequency coil described in SUPPLEMENT, No. 1087? 1. Approximate amount of No. 31 wire needed. A. About 1 pound of No. 31 wire is required for secondary of high frequency coil. 2. Meaning of the words "Between wires of different polarity" at the top of page 17378. I do not see how two such wires can be close enough to need extra insulation. A. Potential would be better than polarity in this phrase. 3. Number of amperes such a transformer will consume. A. A No. 8 wire will carry 30 to 40 amperes. Hence the primary will stand 100 amperes without overheating.

(7673) P. P. Company ask: Does an electrical meter register a greater number of watts when a motor is pulling a two horse load with 90 volt current than it does when pulling the same load with 110 volts, the motor being wound for 110 volts? A. Yes; the motor works at best efficiency only when fully loaded and fully supplied with current.

NEW BOOKS ETC.

REPORT OF UNITED STATES COMMISSIONERS OF FISH AND FISHERIES. 1898. Washington. 1899. Pp. 350.

This volume contains photographic illustrations of the exhibits at the Tennessee and Omaha Expositions, illustrations of the hatcheries at various points, a report of mackerel investigations, statistics regarding the yield of the numerous localities, pictures of peculiar fishes on the coast of Southern California, an extensive report on the oyster beds of Louisiana by H. F. Moore, another report on "The Shad Fisheries" of the Atlantic coast of the United States by Charles H. Stevenson, and a report of the investigations in Mississippi, Louisiana, and Texas. There are also numerous engravings of new fishes.

The Photo-Miniature, a magazine of photographic information, has just begun publication in New York city, Messrs. Tennant & Ward, 289 Fourth Avenue, being the publishers and Mr. Tennant the editor. Periodical photographic literature is already so enormous that it is very hard to welcome even the little stranger to which we have referred. While we do not see the need for the publication of another photographic journal in America, we have no hesitation in saying that "Photo-Miniature" is a very handsome publication. The number is given up to an excellent treatise on lenses and is well illustrated, and the idea is, we believe, to devote an entire number to a single subject, as in the present case, where lenses are treated. The subscription price is \$2.50 per annum.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

MAY 30, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Accumulator plate, H. G. Osburn.....	625,938
Advertising or display card, M. Switzer.....	625,991
Air conveying conduit, liquefied, E. C. Hargrave.....	625,559
Alkaloid casein compounds, making, F. Thomas.....	626,110
Amalgamator, E. J. Verrue.....	625,909
Article holder, P. Reibestein.....	625,805
Automatic fender, O. Cullison.....	625,834
Axle box, railway car, T. Mason.....	626,070
Back pedaling brake, W. H. Alderdice.....	626,194
Back pedaling brake, R. S. Anderson.....	625,732
Barrel stove protector and bung hole bushing, combined, A. Terry, Jr.....	625,814
Battery solution compound, H. Blumenberg, Jr.....	626,046
Bearing, Clay & Gibb.....	626,142
Bedstead rail joint, O. E. A. Wiessner.....	626,043
Berg fountain, J. Dushack.....	626,134
Belt striker, magneto, R. Bruckner.....	625,923
Belt holder, S. Schwarz.....	626,101
Bicycle, T. S. Davis.....	625,835
Bicycle, G. Ellstrom.....	625,749
Bicycle cleaning and repairing stand, C. Colsten.....	625,746
Bicycle guard, B. C. Crane.....	626,045
Bicycle pedal, T. Behan.....	626,155
Bicycle pedal, L. C. Howard.....	625,906
Bicycle propulsion, J. J. Stafford.....	625,873
Bicycle saddle clip, H. R. Cressman.....	625,986
Bicycles, etc., adjustable crank for, F. G. Pen-nock.....	626,062
Billiard cue tip fastener, C. E. Green.....	625,865
Blackboard composition, J. J. Nugent.....	626,115
Boiler tube cleaner, S. D. & N. C. Yeo.....	625,932
Books, machine for making center stitched, A. Von Auw.....	626,127
Boot or shoe cleaner, I. Kinney.....	625,832
Bottle, A. Andrieux.....	626,144
Bottle, non-refillable, F. L. Cook.....	626,027
Bottle steaming cap, P. D. Laible.....	625,822
Box, F. A. Wilson.....	625,958
Box blank material, feed device for, F. P. Ros-back.....	625,963
Boxes, tubes, etc., fastening device for, H. H. Bliss.....	625,959
Bracelet, W. H. Saart.....	625,990
Brazing machine, A. A. Steward.....	625,866
Brick machine, Ayotte & Charbonneau.....	625,781
Brick machine, P. Macarthy.....	625,942
Bridge, sundial, J. C. Kieppel.....	626,169
Broom, O. S. Kulman.....	625,755
Brush making machine, W. H. Gates.....	625,960
Brush, shaving, W. M. Seabury.....	626,051
Buckle shield, A. Burson.....	625,980
Burglar alarm, W. P. Murphy.....	626,207
Burglar alarm, door locking, A. M. Benson.....	625,862
Bustle, H. H. Keil.....	626,035
Butter, case or box for transit of, F. W. Water-idge.....	625,828
Button, badge, A. Phelps.....	625,828
Cable coupling, F. E. Case.....	626,034
Cake turner, J. Middlekauff.....	625,861
Calcium carbide cake, White & Gilbert.....	625,849
Can spout and vent, oil, C. Peuss.....	625,835
Canceled machine, stamp, Vail & Potter.....	626,074
Car brake, W. G. Price.....	626,116
Car coupling lock, J. O'Brien.....	625,885
Car door cleaner, J. M. Miller.....	626,187
Car fender, street, F. Walter.....	625,885
Car seat, J. S. Johnston.....	625,935
Car step lifter, T. Millen.....	626,126
Carbonating machine, F. W. Zingsem.....	626,176
Carburetor, F. Logan.....	626,173
Carburetor, D. M. Small.....	626,137
Card, sample, A. H. Broadway.....	625,858
Cardboard box, J. E. Thornton.....	625,772
Carriage, automotor, H. F. Joel.....	626,008
Carriages, etc., combined step and guard for, F. W. Putnam.....	625,752
Cartridge holding clip, T. C. Johnson.....	625,883
Cash carrier apparatus, W. Hanlon.....	626,053
Caster, ball, F. H. Corduan.....	626,159
Catamenial sack, A. L. Gray.....	625,969
Ceiling tinting device, L. Farber.....	626,085
Cement conduits or pipes, manufacture of, Paine & Given.....	626,139
Cementing apparatus, A. B. McCoy.....	626,138
Chair, W. O. & E. K. Campbell.....	626,198
Check strap or holder, baggage, J. H. Wheelock.....	625,926
Child's barrier, J. Graham.....	625,756
Chimney, W. J. Glover.....	625,921
Chopper. See Ground detector.	
Circuit breaker, rotary, H. Boas.....	625,937
Clamp. See Dental matrix clamp.	
Clip. See Bicycle saddle clip. Cartridge holding clip.....	626,014
Cloth winding bolt frame, skeleton, J. C. Mur-phy.....	625,967
Coal drill, G. F. Weiss.....	625,988
Combing machine for textile materials, E. De-lette.....	625,758
Compound engine, R. E. Bradford.....	625,853
Compound engine, E. W. Harden.....	625,948
Compressed air mechanism for railway rail-stock, etc., F. Schumacher.....	626,033
Compression coupling, F. L. Bickel.....	625,887
Compressor, Charter & Hobart.....	625,915
Condenser, evaporative, H. J. Fraser.....	625,842
Controller, T. Von Zweigbergk.....	626,010
Cooler. See Ground detector.	
Coop, folding, J. N. Suprunowski.....	625,542
Copying device for documents, drawings, etc., A. Ihn.....	625,717
Copying press bath apparatus, F. W. Koch.....	626,077
Cot and canopy, portable folding, S. F. Seely.....	625,932
Coupling. See Cable coupling. Compression coupling.....	
Coupling. See Coupling. Thill coupling.....	
Coupling and draught cushioning device, M. Fink.....	626,154
Coupling for railway wagons, etc., K. C. Mes-zaros.....	626,007
Crayon sharpener, J. J. Fraser.....	625,878
Culvert, W. A. Nichols.....	625,795
Curtain fixture, G. H. Forsyth.....	625,753
Dental matrix clamp, L. P. Leonard.....	625,888
Dental spittoon attachment, F. Hurlbut.....	626,066
Detachable handle for frying pans, J. H. Kendle.....	625,335
Detector. See Ground detector.	
Die box, reversible, J. T. Hicks.....	625,952
Digger. See Potato digger.	
Disk drill, W. F. Hoyt.....	626,024
Docks, device for use in erecting bents of ore, F. R. McQueen.....	625,791
Door check, V. Beauregard.....	625,992
Door hanger, W. Loudon.....	626,071
Dough raiser apparatus, L. D. Burlingham.....	626,000
Drier. See Fruit drier. Grain drier.....	
Drill. See Coal drill. Disk drill.....	
Dust pan, E. E. Rice.....	626,096
Duster holder, feather, J. H. Ford.....	626,040
Ear ring, L. Mann.....	625,890
Educational device, J. H. Gerwig.....	625,881
Electric lighting device, S. E. Mosher.....	625,788
Electric machines, operating dynamo, E. W. Rice, Jr.....	625,806
Electric motors, mechanism for starting, stop-ping, reversing direction of motion, and con-trolling speed of, F. H. Foster.....	626,026
Electric motors, method of and means for regu-lating, R. Lundell.....	626,178
Electric signal, selective, J. A. Barrett.....	626,131
Electrical distribution system, E. Thomson.....	625,816
Electrical meter, preparation, C. O. Bastian.....	626,134
Electrolytic apparatus and process of treating impregnators therefor, M. Perreux-Lloyd.....	626,033
Electrolytic meter, C. O. Bastian.....	626,135
Electromagnetic mechanism, transmitting move-ment to a distance by Raverot & Bely.....	626,009
Engine. See Compound engine. Explosive en-gine. Gas engine. Pumping engine. Rotary engine. Traction engine.....	
Engine, F. J. Fette.....	626,005
Engine, I. B. Hammond.....	626,022
Engine, P. Lafr.....	625,887
Engine stop mechanism, J. Matthews.....	626,071
Engines, speed regulator for explosive, A. Win-ton.....	626,121
Engraving plates, composition for coating, T. H. Bell.....	626,016
Expansion bolt, J. R. Rowlands.....	626,040
Explosive and making same, E. A. G. Street.....	625,948
Explosive engine, L. B. Doman.....	625,839
Explosive engine, A. Winton.....	626,120
Explosive motor, W. Jasper.....	626,050
Eyeletting machine, H. H. Bufum.....	626,209
Fan, electric, Nichols & Erdin.....	625,762
Feed from distillery slop, means for gaining dry, T. Hayes.....	626,125
Feed mill, W. C. F. Zimmerman.....	626,125

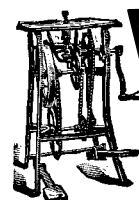
(Continued on page 383)

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - \$1.00 a line
For some classes of Advertisements, Special and Higher rates are required.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.



WOOD or METAL WORKERS

without steam power can save
time and money by using our
Foot and Hand Power Machinery

SEND FOR CATALOGUES—
A—Wood-working Machinery.
B—Lathes, etc.
SENECA FALLS MFG. COMPANY,
695 Water St., Seneca Falls, N. Y.

POWER & FOOT
LATHES.

SHAPERS, PLANERS, DRILLS,
MACHINE SHOP OUTFITS, TOOLS
AND SUPPLIES. CATALOGUE FREE
SEBASTIAN LATHES CO. 120 CULBERT ST. CINCINNATI, O.

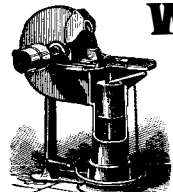
Starrett's Combination Bevel
for laying out work, measuring or
showing any angle desired.
Will lie flat. Stock 4
in. long. Catalogue
shows many uses of
this tool. Catalogue,
12 pages, free. The
L. S. Starrett Co.,
Box 13, Athol, Mass.

Price
\$2.00.

WOODWORKING MACHINERY.

For Planing Mills, Carpenters,
Builders, Furniture, Chair, Vehicle,
Wheel and Spoke Makers, etc.

Correspondence Solicited.
Illustrated 312-page Catalogue free
to manufacturers and foremen.
THE ECAN CO.
327 to 347 West Front Street,
CINCINNATI, OHIO.

Water Emery
Tool Grinder

Has no pumps, no valves. No
piping required to supply it with
water. Always ready for use. Simp-
le construction, most efficient
in operation.

Send for catalogue and prices.
W. F. & JNO. BARNES CO.
1999 Ruby St., Rockford, Ill.

Pipe Threading Machines

of Highest Merit.
COMBINATION BENCH
and PIPE VISES.

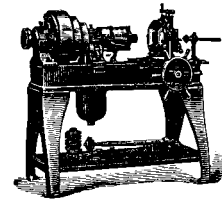
Catalogue containing inter-
esting information free.
Bignall & Keeler Mfg. Co.,
Box S., Edwardsville, Ill.

ARMSTRONG'S PIPE THREADING
—AND—
CUTTING-OUT MACHINES
Both Hand and Power.
Sizes 1 to 6 inches.
Water, Gas, and Steam Fitters'
Tools. Hinged Pipe Vises.
Pipe Cutters. Stocks and Dies
universally acknowledged to be
THE BEST. Send for catalogue.
THE ARMSTRONG MFG. CO.
Bridgeport, Conn.

If You Want the Best Lathe and Drill

CHUCKS
BUY
WESTCOTT'S
Strongest
Grip, Great-
est Capacity,
and Durabil-
ity, Cheap and Accurate.

Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.



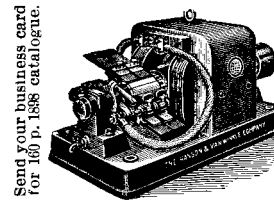
A Marvelous Machine!

Watch the wonderful work
done by our
and Pipe Mill Machine.
Threads nipples of all sizes.
So swiftest that it can be
reversed and pipe cut off close
to grippers. Vise can be open-
ed or closed while machine
is in motion. Send for Cata-
logue. THE MERRELL
MFG. CO., 501 Curtiss
Street, Toledo, Ohio.

The Forbes Patent Die
Stocks for Hand or Power.

It can be used as a power machine
in the shop or taken from the base
and carried out as a hand machine.
Send for Descriptive Catalogue.

CURTIS & CURTIS, No. 78 H. or P. Machine
6 Garden St., Bridgeport, Conn. Range 2 1/2 to 4" R. H.



NICKEL

Electro-Plating
Apparatus and Material.

THE
Hanson & VanWinkle
Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St.
Chicago.

THE HARRINGTON & KING
PERFORATING CO.
LARGEST MANUFACTURERS
IN THE WORLD OF
PERFORATED METALS
STATION F CHICAGO, U.S.A.

Feeding device, F. W. Vickery.....	625,910
Fence machine, wire, M. H. Starling.....	625,107
Fence post, J. Nixon.....	626,083
Fence, wire, R. D. Morgan.....	625,936
Fifth wheel, L. G. Mayer.....	626,184
File, bill, E. J. Carter.....	626,141
Filling block, J. D. Baker.....	625,919
Filter, suction pipe foot valve, J. W. Newman.....	625,794
Fire extinguishers, automatic sprinkler for, C. B. Shaw (reissue).....	11,744
Fireproof draught regulator, open, H. Pannill.....	625,983
Fireproof building construction, E. V. Johnson.....	625,930
Fish and animal trap, combined, J. Cartier.....	625,742
Fish generating apparatus, E. Rossley.....	625,874
Fishing device, automatic, G. Cook.....	625,826
Flanging machine, C. E. Macbeth.....	625,789
Floor cloth, apparatus for manufacturing mo- saic, K. Walton.....	626,117
Floor or sidewalk cleaner, F. W. Richter.....	625,850
Flower holder, W. H. Walker.....	626,015
Fluid separator, automatic, A. J. Simmons.....	625,904
Fluids, suction and force apparatus for, W. M. Morgan.....	625,785
Food chopper, L. T. Snow.....	626,212
Foundry power riddle, U. Eberhardt.....	626,019
Frame, Sewing frame.....	625,778
Fruit drier, C. J. Kurtz.....	626,058
Fruit picker, C. Flegenschmidt.....	626,199
Fuel, binding material for artificial, H. Wolff.....	625,754
Fuel or coal saver, W. S. Garland.....	625,916
Furnace, See Glass annealing furnace. Heating furnace.....	625,912
Furnace fire bridge, J. Alves.....	625,913
Furnace for treating ores, A. G. Wells.....	625,965
Furnaces, exhaust blast apparatus for locomot- ive, J. Whittle.....	625,985
Furniture leg, W. E. Buser.....	625,965
Game, F. A. Killey.....	625,845
Game apparatus, A. H. Bostley.....	625,989
Garbage treating apparatus, J. W. Gable.....	626,157
Gas apparatus, acetylene, W. A. Coulson.....	625,832
Gas, apparatus for producing acetylene, O. Payan.....	626,032
Gas burner regulator, F. O. Robbins.....	626,029
Gas burner, electric mantle for, E. J. Johnson.....	625,986
Gas engine and means for governing same, E. J. Fithian.....	626,155
Gas, extracting cyanogen from coal, J. Bueh.....	625,964
Gas generator, acetylene, H. Berger.....	625,735
Gas generator, acetylene, C. M. Camp.....	625,827
Gas generator, acetylene, W. A. Coulson.....	625,835
Gas generator, acetylene, W. M. Gilbert.....	625,849
Gas generator, hydrogen, I. R. B. Arnold.....	626,200
Gate, See Railway gate.....	625,768
Gate, H. N. Hobart.....	626,180
Gate fastener, Marcum & Hauenstein.....	626,180
Gate opening or closing device, P. C. & A. J. Gib- bons.....	626,158
Gear, friction, Thornton & Lea.....	625,859
Generator, See Gas generator. Steam genera- tor.....	625,801
Glass annealing furnace, W. Preston.....	626,072
Glass press, B. B. Messer.....	625,864
Gold by electrolysis, E. H. Hewlett.....	625,863
Gold, obtaining chemically pure, E. Wohlwill.....	626,148
Grain drier or steamer, R. Dempster.....	625,957
Gramophone, T. S. Parvin.....	626,136
Grate, shaking, F. Berkemeyer.....	625,870
Ground detector, E. H. Hewlett.....	626,012
Hammer, foot power, W. P. Burgett.....	626,196
Hammer, magazine tack, J. P. Van Derveer.....	626,131
Handle, See Detachable handle.....	626,059
Harness, etc., rawhide reinforcement for, J. L. Thom- son.....	625,793
Harness rivet, B. Foote.....	626,123
Harrow, J. & E. T. Baskin.....	625,857
Harrow, S. H. & D. Garst.....	625,892
Harrow, combined spring and spike tooth, J. R. Naylor.....	625,843
Hat fastener, L. Wormser.....	626,073
Hat or cap, A. Klein.....	625,897
Hay ricker, L. Swamp.....	626,204
Heat accumulator, L. Maurice.....	625,779
Heat alarm, electric, H. F. Jones.....	625,747
Heating furnace, pit, J. M. Miller.....	626,091
Heel, cushion, H. O'Sullivan.....	625,851
Hinge, C. Clinger.....	625,951
Hinge, spring, S. Held.....	626,049
Hinge, spring, M. Lane.....	626,210
Horse boot, A. Shappell.....	625,871
Horse tie, J. F. Deadman.....	626,052
Horseshoe, soft tread, Peter & Keigwin.....	626,150
Hose coupling, A. J. Enley.....	626,153
Hose coupling, M. L. Hart.....	626,065
Hose, machine for making, B. O. Hale.....	625,928
Hose making machine, F. H. Brewster.....	625,966
Hose mender or coupling, H. Deitz.....	625,860
Hose nozzle, J. Busha.....	626,011
Ice breaker, rotary, J. W. Tunstall.....	626,001
Ice weighing machine, W. T. Carter.....	625,920
Index holder, J. P. MacLearn.....	625,918
Injector, steam, J. Desmond.....	626,167
Insecticide, E. F. Eichholtz.....	626,147
Insulated joint for electric fixtures, E. E. Clift.....	626,138
Insulator, W. R. Holmes.....	626,188
Iron, treating machine, J. R. Billing.....	625,841
Ironing machine, C. E. Carpenter.....	626,161
Irrigating system, W. R. Thornton.....	625,898
Jack, See Lifting jack.....	626,201
Jar, See Strup jar.....	626,094
Joint, See Insulated joint. Slip joint. Umbrella rib joint.....	625,847
Jug carrier, F. O. Balch.....	625,847
Knitting machine, G. F. Sturgess.....	626,114
Knitting machine needle, J. Vernon.....	626,174
Lace fastening, shoe, M. H. Lipman.....	625,943
Lamp, acetylene gas, Walbel & Meytrott.....	625,848
Lamp, acetylene, gas, Walbel & Meytrott.....	626,190
Lamp, electric arc, J. R. Pepin.....	626,017
Lamp, incandescent electric, R. W. Carroll.....	625,944
Lamp support, White & Goetz.....	625,903
Lamp, unchangeable incandescent, A. Schirner.....	625,782
Lamp, drip trough for central draught, J. C. Miller.....	626,011
Land roller and seed planter, combined, R. Stuck- wisch.....	626,001
Lantern, bicycle, P. J. Creeden.....	625,988
Lawn sprinkler, A. T. Snell.....	625,920
Lawn sprinkler, traveling, W. Ballerstedt.....	625,918
Lead, process of, and apparatus for producing white, E. Bailey et al.....	625,838
Leather drying apparatus, R. Mohun.....	625,819
Lemon squeezer, L. M. Devore.....	626,023
Letter and package deposit box, street, S. D. Warfield.....	626,205
Lid holder, H. H. Gnyall.....	626,086
Lifter, See Log lifter.....	625,972
Lifting jack, E. F. Hamlin.....	626,021
Lifting jack, J. H. Osborne.....	625,825
Linotype or analogous machine, E. Girod.....	626,167
Liquid or viscous substances, device for retain- ing, A. H. Gerdson.....	626,147
Lock, H. A. Anderson.....	626,102
Lock, O. Katzenberger.....	626,138
Lock and latch, combined, O. F. Day.....	626,188
Log lifter, H. W. Scott.....	625,928
Log thawing apparatus, S. W. Butterfield.....	626,161
Loom, J. H. Northrop.....	625,898
Loom for weaving chenille fabrics, H. Hardwicke.....	626,201
Loom let off and take up, A. J. Hanks.....	626,094
Loom warp stop motion, J. Poyser.....	626,129
Looms, fling end holder for automatic, G. O. Draper.....	625,847
Lubricating apparatus, L. Kaczander.....	625,790
Lubricator, C. J. Miller.....	625,809
Mail bag catcher, I. F. J. McKinstir.....	625,844
Maltng apparatus, C. Schwager.....	625,976
Map holder, road, Kelso & Wilbur.....	626,063
Massage machine, W. W. M. Hickey.....	625,933
Match making machine, I. Hogeland.....	626,002
Measuring device, grain, G. Schobert.....	626,173
Mechanical movement, P. J. Riley.....	625,744
Medicine box, F. C. Groneman.....	626,129
Meter, See Electrical meter. Electrolytic meter. Wattmeter.....	625,982
Milk cooler, W. A. Nash.....	626,028
Mill, See Feed mill. Quartz mill.....	625,984
Mill for grinding bone carbon, etc., E. Lister.....	625,981
Mill spout, D. Parks.....	626,018
Mould, See Tank mould.....	626,094
Motor, See Explosive motor. Railway motor. Wave motor.....	626,129
Mowing machine attachment, J. Mussell.....	626,129
Mud guard, Dunlop & Oatway.....	626,129
Mule, self-acting, J. Ramsden et al.....	626,129
Music rack and leaf turner, sheet, G. E. Scott.....	626,129
Musical instrument, stringed, J. S. Young.....	626,129
Nail forming machine, S. L. Reed.....	626,129
Necktie holder, H. A. Littig.....	626,129
Nest, hen's, J. B. Williams.....	626,129
Nesting box, J. Herfert.....	626,129
Noodle machine, C. Buerk.....	626,129
Notion box, H. Hyatt.....	626,129
Nut lock, W. J. Purvis.....	626,129
Oils, refining, C. de La Roche.....	626,129
Ordnance on ships, apparatus for firing, M. J. Caudros.....	626,129
Ores, apparatus for treating, M. F. Leech.....	626,129
Organ attachment, S. Howard.....	626,129
Organs, adjusting and transposing device for au- tomatic, M. Clark.....	626,129
Packing for bottles, etc., H. A. Leak.....	626,129
Packing, piston rod, J. Badeker.....	626,129

(Continued on page 384)

Elgin Watches,
by their superior construction, insuring
endurance and accurate time-telling under all
conditions of temperature, position and railway
service, are recognized universally as
The World's Standard.
They come in various sizes, for men, women and youth, encased to suit
every taste. An Elgin watch always has the word "Elgin" engraved on
the works. Fully guaranteed.
A "Book about Watches" is sent free to all who write for it.
ELGIN NATIONAL WATCH COMPANY, Elgin, Ill.

THE OBER LATNES

For Turning Axe, Adze, Pick,
Sledge, Hatchet, Hammer, Aug-
er, File, Knife and Chisel Han-
dles, Whiffletrees, Yokes, Spokes,
Porch Spindles, Stair Balusters,
Table and Chair Legs and other
irregular work.
Patented. Send for Circular A.
The Ober Lathe Co., Chagrin Falls, O., U. S. A.

REEVES'
Variable Speed Counter Shaft
for securing any speed without change of belt
or loss of time. Specially adapted for all
kinds of experimental machinery, Printing
Presses, Motor Carriages, Ironworking Tools,
Woodworking Machinery, or any and all ma-
chines requiring a change of speed or feed.
Send for handsomely illustrated
Catalogue "S. A." free.
REEVES PULLEY CO., Columbus, Ind., U. S. A.

BEST MACHINES
for DRYING Grain, Sands, Clays, Fer-
tilizers, Coffee, Wet Feeds, Chemicals,
Salt, Sugar, etc. Also COFFEE
HULLERS and CLEANERS.
Send for 6th Illustrated Catalogue.
S. E. Worrell, Hannibal, Mo., U. S. A.

Look to the Water You Drink
Distilled Water—100% Pure from the Sanitary Still.
TESTIMONIALS—Physicians' endorsements and full particulars by return mail.
Only Still recognized by the U. S. Government. Six Styles, \$10 up.
THE CUPRIGRAPH CO., 138 No. Green St., Chicago.

THE EUREKA CLIP
The most useful article ever invented
for the purpose. Indispensable to Law-
yers, Editors, Students, Bankers, Insur-
ance Companies and business men gen-
erally. Book marker and paper clip.
Does not mutilate the paper. Can be
used repeatedly. In boxes of 100 for 25c.
To be had of all book sellers, stationers
and notion dealers, or by mail on receipt
of price. Sample card, by mail, free. Manu-
factured by Consolidated Safety
Pin Co., Box 21, Bloomfield, N. J.

This beats Wind, Steam, or Horse Power.
We offer the WEBSTER 2 1/2 actual horsepower
GAS ENGINE
for \$150, less 10 per cent discount for cash. Built
on interchangeable plan. Built of best material.
Made in lots of 100 therefore we can make the price.
Boxed for shipment, weight 800 lbs. Made for Gas
or Gasoline. Also Horizontal Engines, 4 to 30 h. p.
WEBSTER MFG. CO.,
1074 West 15th St., Chicago.
Eastern Branch, 38-D Day Street, New York City.
Southern Agents: Boland & Gachwind Co., Ltd.,
So. Peter and Lafayette Sts., New Orleans, La.

**PIERCE REVERSIBLE
Speed Propellers**
ALL BRONZE 13 TO 24 IN.
Send for circulars and prices.
PIERCE ENGINE CO.,
17 N. 17th Street, Racine, Wis.

Do you want an up to date Vapor Sausch?
Due to forty horse power. Write to us for prices.
Racine, Wis. & Boat Works, Racine Junction, Wis.

Our Folding Boats are puncture proof. Galvanized steel ribbing. For hunting, fishing, exploring and family
pleasure. Walter Wellman took them on his polar trip. Lieut. Schwatka explored
the Yukon with them. Awarded first premium at World's Fair. Send 6c. for cat-
alogue. 40 engravings. **KING FOLDING CANVAS BOAT CO., Kalamazoo, Mich.**

FULL VALUE For the Money.
You are entitled to that. It does not mean simply that you should get the
best goods for the money, but also that you should be saved the
added expense of agent's commissions,
dealer's profits, salesman's expenses, etc.
We save you all this by selling you direct
from our factory at wholesale prices.
**We are the largest manufac-
turers in the world selling
vehicles and harness to the
consumer exclusively.**
We make 170 styles of vehicles and 65
styles of harness. We ship anywhere
for examination and guarantee every-
thing. Send your name on a postal
card for **Free Illustrated Catalogue.**
ELKHART CARRIAGE & HARNESS MFG. CO. W. B. Pratt, Sec. ELKHART, INDIANA.

What is Your Work?

If you are dissatisfied with your situation, your salary, your chances of complete success, write to The International Correspondence Schools, Scranton, Pa., and learn how others so situated are getting an education by mail.

Students in the courses of Mechanical or Electrical Engineering, Architecture, or any of the Civil Engineering Courses are soon qualified for salaried drafting room positions. Write for pamphlets.

The International Correspondence Schools, Box 942, Scranton, Pa.

ROSE POLYTECHNIC INSTITUTE

A College of Engineering, Mechanical, Electrical, Civil Engineering, Chemical Courses, Architecture. Extensive shops. Modernly equipped laboratories in all departments. Expenses low. 17th year. For catalog address C. L. MEES, President, Terre Haute, Ind.

BLISS ELECTRICAL SCHOOL

711 14th Street, Washington, D. C. Practical Electrical Engineering thoroughly and exclusively taught. Course opens Sept. 27. Catalogue on application to L. D. BLISS, Principal.

COBURN PATENT TROLLEY TRACK

Parlor, Barn and Fire Door Hangers
All Styles.
Latest Improvements.
Send for Book.
Coburn Trolley Track Mfg. Co.
Holyoke, Mass.

ROCK DRILLS AIR COMPRESSORS

SIMPLEST, MOST EFFICIENT and DURABLE.
RAND DRILL CO.
Send for Catalogue. 100 Broadway, New York.

WHEN DID IT HAPPEN?

Don't be in doubt if it is a matter of time by recording it with the **AUTOMATIC TIME STAMP**. It records the exact second, minute, hour, day and month; also imprints the owner's name and the nature of the transaction. Indispensable in all offices, workshops, factories and banks. Every business house should have one. Run by clockwork. Can't get out of order. Absolutely reliable. Send for illustrated circular.

AUTOMATIC TIME STAMP CO.,
160 A Congress St., Boston, Mass., U. S. A.

Economy Drilling Compound

Superior to Oil or other Lubricants.
Keeps Tools Cool and Sharp, Produces Smooth Work and Fine Finish, is Clean and Does Not Rust or Gum. Adopted by U. S. Government, Railroads and Leading Manufacturers. Barrels, 5, 10, 20, 40, 80, 160 lb. Freight prepaid. Sent on approval.

THE WHITE & BAGLEY COMPANY,
WORCESTER, MASS., U. S. A.

HERE IS SOMETHING NEW

OUR "RELIABLE" J. R. A 50-ft. Steel Measuring Tape that weighs only 5 ounces complete. For vest pocket. Leather case, 4 1/2 in. tape; our patent flush handle, nickel trimmings; guaranteed accurate; is practical, durable, convenient, and elegant; outside dimensions of case 2 1/2 in. diameter and 1/2 in. thick; made in 40ths or 16ths. Mailed upon receipt of \$4.00. If not entirely satisfactory, return and will refund money.

Send for our Measuring Tape Catalogue B.
LUFKIN RULE CO., Prescott Avenue, Saginaw, Mich.

**COMBINED
Surface & Buzz Planer**

Panel and Rotary Bed Planers, Shaping, etc.
Water Rams, Water Wheels.
Send for Circulars.
C. & A. HODGKINS CO.,
Marlboro, N. H.

A Paint Pointer

Paint is used with two objects in view—as a preservative and as a beautifier. To be a good preservative, it must be durable; as a beautifier, it must have a fine gloss and smooth finish.

DIXON'S SILICA-GRAPHITE PAINT

possesses both qualities in a remarkable degree, and has many more marks of excellence as well. If not only lasts longer than any other paint, but covers two or three times as much surface.

"Equally good on metal or wood." It has no bad odor and is strictly non-poisonous. It never fades.

Write for Color Cards and Circulars to
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

USE GRINDSTONES?

If so, we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. Ask for catalogue.

The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

DEFIANCE MACHINE WORKS
DEFIANCE, OHIO, U.S.A.
BUILDERS OF
HUB, SPOKE,
WHEEL, BENDING,
WAGON, CARRIAGE
AND HOOP
MACHINERY.
SEND FOR CATALOGUE.

Padlock, permutation, J. A. L. Snyder.....	625,989
Pan. See Dust pan. Self-basting pan.....	
Paper making, E. S. Sinclair.....	625,941
Paper pulp, refining engine of Jordan type for grinding, S. R. Wagg.....	625,818
Patterns, marking out, J. Marsden.....	626,182
Pen, J. Weeks.....	625,985
Pen wiper, I. N. Weitzel.....	626,197
Perambulator, rolling, B. Jones.....	626,025
Photoreproduction process and apparatus, J. T. Bentley.....	625,734
Piano plate and back, combined, F. V. Neuville.....	625,848
Piano sounding board, E. Zoega.....	625,824
Picker. See Fruit picker.....	
Picture generator, A. Peterson.....	625,939
Piles, driving, T. A. Kearns.....	625,978
Pin. See Safety pin.....	
Pipe. See Tobacco pipe. Water and steam pipe.....	
Pipe wrench, J. J. Rhineland.....	626,037
Pitman, N. D. Stanley.....	626,105
Plating machine, J. D. Hatcher.....	625,761
Planter, seed, J. W. Clark.....	625,743
Planter, seed, W. J. Kerr.....	625,774
Plaster block, M. G. F. Buckley.....	625,869
Plow, C. W. Reed.....	626,065
Plow, disk, E. M. Heyman.....	625,764
Post. See Fence post.....	
Potato digger, J. Hiss.....	625,766
Press. See Glass press. Printing press.....	
Printing and registering machine, Ohmer & Kelch.....	626,084
Printing, art of and apparatus for making ready forms for, J. W. Osborn.....	626,031
Printing on cards, apparatus for stencil, F. Ellam.....	625,876
Printing press, J. C. Molloy.....	626,076
Printing press inking apparatus, B. Huber.....	625,771
Propelling mechanism, boat, P. R. Trethewey.....	625,942
Propelling mechanism, vessel, A. Stathakis.....	625,907
Provision of vices, pneumatic, W. Carr.....	626,149
Pulling shear, S. E. O'Dell.....	625,836
Pulley, self-locking sling, J. H. Burkholder.....	625,924
Pumping engine, single expansion plunger, A. H. Reeder.....	625,900
Quartz mill, N. McAulay.....	626,079
Quitting frame, L. D. Smith.....	625,854
Quinn and caffeine, making, C. a soluble preparation of, A. Kreidmann.....	625,886
Rack. See Music rack.....	
Rail brace, safety, J. A. McCann.....	626,080
Railway brake, continuous, E. M. L. Duval.....	625,004
Railway gate, Carrier & Clow.....	625,740
Railway motor, E. D. Hayes.....	625,802
Railway signal, electrically controlled and operated, W. Daves.....	625,875
Railway switch, A. A. Strom.....	625,911
Railway switch detector bar, Carrier & Clow.....	625,741
Railway system, electric, B. E. Osborn.....	625,791
Railway tie, S. McElfatrick.....	625,791
Railway tie plate, A. B. Harris.....	625,884
Range oven door, H. Born.....	626,047
Razor stropping device, W. H. Nicholls.....	626,186
Refrigerating purposes, liquefied air container for, E. C. Hargrave.....	625,760
Refrigerator, ice, adjustable floor for, Graham & Pierce.....	626,061
Ring. See Bar ring.....	
Roller. See Land roller.....	
Roofing, metallic, W. Heidt.....	626,006
Rotary engine, H. H. Ames.....	625,731
Rotary engine, H. H. Ames.....	625,731
Rotary engine, Pickel & Snyder.....	625,799
Rotary engine, A. Wildermuth.....	625,820
Rubber compound, J. C. Petmucky.....	626,092
Safety pin, C. C. Vilas.....	625,994
Sash operating mechanism, G. A. Ohl.....	626,030
Scarf, folding window, W. C. Stull.....	625,791
Scale, computing, O. O. Ozias.....	625,798
Scalper, grader, purifier, and bolter, A. W. Haag.....	626,160
Scarf or necktie, C. A. Tucker.....	625,817
Scraper, chopper, and cultivator, combined corn and cotton, R. J. Sevier.....	626,103
Screen. See Shaking screen.....	
Seal, J. Dela Mar.....	625,836
Self-basting pan, L. Maybee.....	626,029
Separator. See Fluid separator.....	
Sewer gas trap, J. P. Putnam.....	625,899
Sewing machine, buttonhole, F. W. Ostrom.....	626,189
Sewing machine, thread controller, buttonhole, F. W. Ostrom.....	626,087
Shaft clutching and releasing device, W. A. Vaughn.....	626,113
Shafts, device for imparting end play to, H. W. Buck.....	625,826
Shaking screen and separator, C. W. Parsons.....	626,030
Shears. See Pruning shears.....	
Sheathing and lath, combined, O. R. Dahl.....	626,003
Sheet metal box making machine, T. L. Carbone.....	625,872
Ship's ventilator, Eaton & Bailey.....	626,152
Sign, advertising, W. M. Thawley.....	625,815
Signal, electric, railway signal.....	
Silvering or gilding solutions to glass, porcelain, etc., means for applying, A. Barnes.....	625,733
Slag, apparatus for treating, E. A. Uehling.....	625,992
Slip joint, combination, Mock & Smead.....	626,075
Sole rough rounding and channeling machine, J. E. Bertrand.....	625,736
Sole, shoe, C. H. Wiley.....	625,821
Soup powder and making same, W. B. Gere.....	625,880
Spigot, C. H. Newton.....	626,082
Spinning jenny, W. H. H. Sisum.....	625,811
Spinning machine and process, Ding Cie Sui.....	626,195
Spoon and leader box, E. A. Mocker.....	625,893
Sprinkler. See Lawn sprinkler.....	
Stairway or elevator, moving, L. G. Souder.....	625,905
Stammering, device for aiding cure of, R. B. G. Gardner.....	625,879
Starching machine, Hagen & Cooper.....	625,973
Steam boiler, R. White.....	626,115
Steam generator, C. Q. Hayes.....	625,103
Steering mechanism, R. H. Freeman.....	626,156
Stencils, perforator for producing, E. de Zuccato.....	625,914
Stone planer for planing curved surfaces, J. N. Durkee.....	625,968
Stopper. See Water bag stopper.....	
Storage bin or refrigerator, J. Berquist.....	625,947
Stovepipe attachment and water heater, T. Weinbart.....	625,911
Strainer, milk, E. S. Lagerquist.....	626,170
Sugar, moulding, J. Putzeys.....	626,036
Support or bracket, flexible, W. S. Arnold.....	625,917
Suspenders, R. J. Baiders.....	625,997
Sward from sidewalks, device for cutting away, P. Huddle.....	625,977
Switch. See Railway switch.....	
Sirup jar, J. Ormerod.....	626,085
Tank, G. L. Reensier.....	626,191
Tank. See Vacuum tank.....	
Tank mould, water, G. W. Clark.....	626,054
Tanning, A. Mario.....	626,181
Tanning extracts, making, P. G. Sanford.....	626,100
Tanning vat, B. P. Bradford.....	626,048
Telegraphy by means of electric lights, K. Zickler.....	625,823
Telephone connecting circuit, Thompson & Wales.....	626,111
Telephone lines, selective privacy switch for multiple station, J. A. Barrett.....	626,132
Telephone switchboard, J. M. Overshiner.....	625,797
Telephone toll circuit, Crane & Wales.....	626,146
Thermometer, clinical, S. Ankauer.....	626,124
Thill coupling, W. Knapp.....	625,956
Thill coupling, J. W. Kohn.....	626,026
Thresher attachment, J. Taylor.....	626,041
Thresher, pea or bean, Mahon & Gower.....	625,846
Threshing machine cross conveyor, F. C. Stuckel Tie. See Horse tie. Railway tie.....	626,108
Tie plug, W. Goldie.....	626,060
Tires upon vehicle wheels, device for use in securing elastic, W. Holmes.....	625,769
Tobacco pipe, J. Tobin.....	626,112
Tobacco, style of manufactured, W. A. Fretwell.....	625,970
Tobacco treating apparatus, R. B. Dula.....	626,202
Tool heads, shifting device for revolving, F. Lucke.....	626,208
Torpedo attachment, boat, J. P. B. Sadler.....	625,851
Towel holder, R. M. Panoast.....	626,089
Track scraping, sweeping, and sanding machine, J. H. Robertson.....	626,039
Traction engine, G. W. Morris.....	626,077
Transformer or synchronous motor, rotary, B. G. Lamme.....	626,172
Trap. See Fish and animal trap. Sewer gas trap.....	
Trolley catcher, F. N. Kelsey.....	626,168
Truck, car, J. W. Cloud.....	625,925
Truck, car, H. Kintz.....	626,211
Truck, passenger car, E. Cliff.....	625,745
Tunnel lining, T. H. Murphy.....	626,078
Tunneling shield, C. G. Hastings.....	626,063
Turning round bars, machine for, L. H. Brightman.....	625,922
Twine binder tension device, O. B. Lofstedt.....	626,175
Type casting and composing machine, J. S. Bancroft.....	625,993
Type setting apparatus, Johnson & Low.....	625,931
Typewriter desk, H. B. S. Siders.....	625,852
Typewriters, mechanical instrument for, V. Curnerson.....	626,056
Typewriting machine, E. S. Shimer.....	626,104
Typographic machine, I. Risley.....	626,097
Typographic machine, Risley & Lake.....	626,098
Umbrella rib, joint, fold, C. E. Frost.....	625,825
Vacuum tank and water lifter, L. L. Gros.....	625,882
Valve, C. E. Huxley.....	625,954
Valve, automatic, J. H. Derby.....	625,748
Valve, compressor, F. G. Hobart.....	626,064

(Continued on page 385)

"THE BELLE OF ALL BICYCLE BELLS"

the purest and clearest in tone and easiest of action is the
"ROYAL" BICYCLE BELL
manufactured exclusively by us. It has grown to be extremely popular among wheelmen on account of its responsive touch and sonorous ring. It is made of the finest bell metal and yields an electric response to pressure. Double pivot steel strikers. Superb nickel finish. It is the bell most approved by the best riders. Clubs and experts adopt it on account of its manifest superiority over all other bells on the market. Wherever tried it at once becomes the favorite.

Send for free illustrated catalogue "S. A." of all our bicycle supplies.
EDWARD MILLER & CO. Factories and Salesrooms.
STONES: 28 & 30 West Broadway, New York. 63 Pearl St., Boston.
Manufacturers of "Everlit" Oil and "Majestic" Gas Lamps.



Every Tool for Every Use

A complete list of all the Tools made for any and every purpose, all fully described and accurately illustrated will be found in the 1898 edition of **MONTGOMERY & CO.'S TOOL CATALOGUE**. It contains 510 closely printed pages with index. Book is pocket size, 6 1/2 x 4 1/4 inches, with rounded edges and stitched covers. Sent free by mail on receipt of 25 cents by
MONTGOMERY & CO.
105 Fulton Street, New York.

CRITERION
Acetylene Gas GENERATORS
SAVE 50% in lighting buildings of every description, anywhere. Any capacity. From \$15 up.
Send for New Catalogue.
J. B. COLT & CO., DEPT. N.
3-7 West 29th St., New York.

H. & R. Arms Co.'s Hammerless

32 and 38
Caliber S. & W.
Cartridges, Automatic Shell Ejecting. Positive Stop on Cylinder.
AN ABSOLUTELY SAFE ARM.
HARRINGTON & RICHARDSON ARMS CO.
WORCESTER, MASS., U. S. A.
Send for Descriptive Catalogue "S."

If You Will Scorch,
PUT A
Liberty Bell
On Your Wheel.
Continuous Ringing. Adjustable Push-Button. Gong does not turn when Bell Rings.
THE LIBERTY BELL CO.,
(FORMERLY THE BRISTOL BELL CO.)
BRISTOL, CONN., U. S. A.

A \$5 PRINTING PRESS
SEND FOR THIS
print your cards, labels etc. Saves money. Large circular press \$18. Full printed instructions for use. Catalogue and samples free.
KELSEY & CO., Mrs., Meriden, Conn.

YAN NORMAN
UNIVERSAL BENCH LATHES
with milling attachment will be found to meet all the requirements of fine tool and gauge work, experimental work and light manufacturing. Send for circular.
WALTHAM WATCH TOOL CO., Springfield, Mass., U. S. A.

The utmost precision in grinding cups and cones for Automobiles and Bicycles is obtained by using the
NEW "RIVETT" PATENT GRINDERS.
For particulars and catalogue, address
FANEUIL WATCH TOOL CO.,
Brighton, Boston, Mass.
Makers of the Celebrated "Rivett" Precision Lathes.

SUBMARINE TELEGRAPH.—A popular article upon cable telegraphing. SCIENTIFIC AMERICAN SUPPLEMENT, 1124. Price 10 cents. For sale by Munn & Co. and all new dealers.

BEST BICYCLE BRAKE
All cyclists, whatever wheel they ride, should have attached the Latest and Best Automatic Coaster and Brake.
THE TREBERT BRAKE
is composed of a friction disk secured to the hub of rear wheel, a clutch on the disk and a clutch on the rear sprocket wheel. Both clutches have inclined surfaces upon which balls roll. When the bike chain is pulled forward, the balls also move forward and ride up their incline. Back pressure to pedals produces reverse motion. Free booklet of particulars. Made only by the
Trebert Automatic Coaster and Brake Co., SYRACUSE, N. Y.

COASTING UNDER CONTROL.

It's an easy matter to Coast at full speed, to slacken or increase speed, or to stop altogether without any danger if you are riding the

Eclipse Bicycle with Morrow Automatic COASTER and BRAKE.

You can keep your feet on the pedals and Coast at will. A back pressure instantly applies brake; a forward pressure promptly frees it. Thus you have the wheel at all times under complete control. Simple, Safe, Sure. Write us about it.

ECLIPSE BICYCLE COMPANY, Box X, ELMIRA, N. Y.

NOEL'S Safety Car-lock, patented in United States and Canada, of absolute superiority to any in use. These patents FOR SALE outright. Circulars and models will be sent to intending purchasers. Address all communications to: A. NOEL, Father Point, County Rimouski, Province Quebec, Canada.

The Ladies' Delight
The Robinson Thermal Bath Cabinet. The only bath that makes you clean. The only bath that makes you well. The only bath that makes beautiful Complexion.
Men enjoy it better than Turkish Baths.
Prices \$3.50, \$7.50 and \$12.50.
Our Cabinet opens at top to cool off; others do not. Awarded First Premium at Omaha Exposition.
Over Four Hundred Thousand Cabinets in use. Every ailment can be cured or benefited. The Robinson Cabinet folds like a screen into six inch space. It is patented. Beware of infringements, as you are liable to prosecution. We sell on 30 days trial. Get a Cabinet and purify your blood before Hot Weather. Send for free book, "Health and Beauty," and treatment on all diseases. We have a Branch Office in every large city, where our Cabinet can be seen before purchasing. Good agents wanted. We furnish capital. Write at once
ROBINSON THERMAL BATH CO.,
700-717 Jefferson Street, TOLEDO, OHIO

The Ladies' Delight

The Robinson Thermal Bath Cabinet. The only bath that makes you clean. The only bath that makes you well. The only bath that makes beautiful Complexion.
Men enjoy it better than Turkish Baths.
Prices \$3.50, \$7.50 and \$12.50.
Our Cabinet opens at top to cool off; others do not. Awarded First Premium at Omaha Exposition.
Over Four Hundred Thousand Cabinets in use. Every ailment can be cured or benefited. The Robinson Cabinet folds like a screen into six inch space. It is patented. Beware of infringements, as you are liable to prosecution. We sell on 30 days trial. Get a Cabinet and purify your blood before Hot Weather. Send for free book, "Health and Beauty," and treatment on all diseases. We have a Branch Office in every large city, where our Cabinet can be seen before purchasing. Good agents wanted. We furnish capital. Write at once
ROBINSON THERMAL BATH CO.,
700-717 Jefferson Street, TOLEDO, OHIO

If You Will Scorch,
PUT A
Liberty Bell
On Your Wheel.
Continuous Ringing. Adjustable Push-Button. Gong does not turn when Bell Rings.
THE LIBERTY BELL CO.,
(FORMERLY THE BRISTOL BELL CO.)
BRISTOL, CONN., U. S. A.

Experimental Science

By GEO. M. HOPKINS.
20th Edition Revised and Enlarged.
914 Pages, 820 Illustrations.
Price \$4.00 in cloth; \$5.00 in half morocco, postpaid

THIS is a book full of interest and value for Teachers, Students, and others who desire to impart or obtain a practical knowledge of Physics. This splendid work gives young and old something worthy of thought. It has influenced thousands of men in the choice of a career. It will give anyone, young or old, information that will enable him to comprehend the great improvements of the day. It furnishes suggestions for hours of instructive recreation.

Send for large Illustrated Circular and complete Table of Contents.
MUNN & CO., Publishers,
Office of the SCIENTIFIC AMERICAN,
361 BROADWAY, NEW YORK.

BEST BICYCLE BRAKE

All cyclists, whatever wheel they ride, should have attached the Latest and Best Automatic Coaster and Brake.
THE TREBERT BRAKE
is composed of a friction disk secured to the hub of rear wheel, a clutch on the disk and a clutch on the rear sprocket wheel. Both clutches have inclined surfaces upon which balls roll. When the bike chain is pulled forward, the balls also move forward and ride up their incline. Back pressure to pedals produces reverse motion. Free booklet of particulars. Made only by the
Trebert Automatic Coaster and Brake Co., SYRACUSE, N. Y.

COASTING UNDER CONTROL.

It's an easy matter to Coast at full speed, to slacken or increase speed, or to stop altogether without any danger if you are riding the

Eclipse Bicycle with Morrow Automatic COASTER and BRAKE.

You can keep your feet on the pedals and Coast at will. A back pressure instantly applies brake; a forward pressure promptly frees it. Thus you have the wheel at all times under complete control. Simple, Safe, Sure. Write us about it.

ECLIPSE BICYCLE COMPANY, Box X, ELMIRA, N. Y.

JUST PUBLISHED.

Mechanical Movements

POWERS, DEVICES AND APPLIANCES.

By GARDNER D. HISCOX, M. E.

Author of "Gas, Gasoline and Oil Engines."

Large 8vo. 402 Pages. 1649 Illustrations,
with Descriptive Text. PRICE, \$3.00.

A dictionary of Mechanical Movements, Powers, Devices, and Appliances, with 1649 illustrations and explanatory text. This is a new work on illustrated mechanics, mechanical movements, devices and appliances, covering nearly the whole range of the practical and inventive field, for the use of Mechanics, Inventors, Engineers, Draftsmen, and all others interested in any way in mechanics.

-SECTIONS.-

1. **Mechanical Powers.**—Weights, Revolution of Forces, Pressures, Levers, Pulleys, Tackle, etc.
2. **Transmission of Power.**—Ropes, Belts, Friction Gear, Spur, Bevel, and Screw Gear, etc.
3. **Measurement of Power.**—Speed, Pressure, Weight, Numbers, Quantities, and Appliances.
4. **Steam Power—Boilers and Adjuncts.**—Engines, Valves and Valve Gear, Parallel Motion Gear, Governors and Engine Devices, Rotary Engines, Oscillating Engines.
5. **Steam Appliances.**—Injectors, Steam Pumps, Condensers, Separators, Traps and Valves.
6. **Motive Power—Gas and Gasoline Engines.**—Valve Gear and Appliances, Connecting Rods and Heads.
7. **Hydraulic Power and Devices.** Water Wheels, Turbines, Governors, Impact Wheels, Pumps, Rotary Pumps, Siphons, Water Lifts, Ejectors, Water Rams, Pumps, Indicators, Pressure Regulators, Valves, Pipe Joints, Filters, etc.
8. **Air Power Appliances.**—Wind Mills, Belows, Blowers, Air Compressors, Compressed Air Tools, Motors, Air Water Lifts, Blow Pipes, etc.
9. **Electric Power and Construction.**—Generators, Motors, Wiring, Controlling and Measuring, Lighting, Electric Furnaces, Fans, Search Light and Electric Appliances.
10. **Navigation and Roads.**—Vessels, Sails, Rope Knots, Paddle Wheels, Propellers, Road Scrapers and Roller, Vehicles, Motor Carriages, Tricycles, Bicycles, and Cycles.
11. **Gearing.**—Racks and Pinions, Spiral, Elliptical, and Worm Gear, Differential and Stop Motion Gear, Epicycloidal and Planetary Trains, "Ferguson's" Paradox.
12. **Motion and Devices Controlling Motion.**—Ratchets and Pawls, Cams, Cranks, Intermitent and Stop Motions, Wipers, Volute Cams, Variable Cranks, Universal Shaft Couplings, Gyroscopes, etc.
13. **Horological.**—Clock and Watch Movements and Devices.
14. **Mining.**—Quarrying, Ventilation, Hoisting, Conveying, Pulverizing, Separating, Roasting, Excavating, and Dredging.
15. **Mill and Factory Appliances.**—Hangers, Shaft Bearings, Ball Bearings, Steps, Couplings, Universal and Flexible Couplings, Clutches, Speed Gears, Sprockets, Screw Threads, Holders, Machines, Textile Appliances, etc.
16. **Construction and Devices.**—Mixing, Testing, Stump and Pile Pulling, Tackle Hooks, Pile Driving, Dumping Cars, Stone Grips, Derricks, Conveyor, Timber Splicing, Roof and Bridge Trusses, Suspension Bridges.
17. **Draughting Devices.**—Parallel Rules, Curve Delimiters, Trammels, Ellipsographs, Pantographs, etc.
18. **Miscellaneous Devices.**—Animal Power, Sheep Shears, Movements and Devices, Elevators, Cranes, Sewing, Typewriting, and Printing Machines, Railway Devices, Trucks, Brakes, Turntables, Locomotives, Gas Gas Furnaces, Acetylene Generators, Gasoline Mantel Lamps, Fire Arms, etc.

* Copies prepaid to any address on receipt of price.

Send for Descriptive Circular.

MUNN & CO., Publishers,
SCIENTIFIC AMERICAN OFFICE,
361 BROADWAY, NEW YORK.

MAGAZINE PLATE HOLDERS
CAN BE FITTED TO ANY CAMERA PATENTED
HOLDS 12 PLATES
4x5 \$10.00
5x7 \$12.00
FREE CATALOGUE OF 20 STYLES OF "GRAPHIC" CAMERAS.
SPECIAL CAMERAS MADE TO ORDER.
THE FOLMER & SCHWING MFG CO.
271 CANAL ST. NEW YORK.

SAW HAMMERINGInstructions on approval to men of experience only.
MINER, LUMBERTON, MISS.

BICYCLE CHAINS
Kept Clean and Oiled. Our chain brush does the business. Works automatically. Attaches to rear stay, has top and bottom brushes. Can't get out of order, keeps chain free from dust, mud, and always oiled. Postpaid in cents, in stamps. Every purchaser becomes agent.
HUTCHES & CO., 620 Isabella Bldg., Chicago, Ill.

The Most Reliable General Telephone Apparatus Manufacturers in the World.

SWITCHBOARDS the BEST on the Market.
TELEPHONES UNEQUALLED for Accurate Service.
Complete and Perfect CENTRAL ENERGY SYSTEM.
Send for Catalogue. Write for Information.

VICTOR TELEPHONE MFG. CO.,
166 SOUTH CLINTON ST., CHICAGO.

"American-Hunnings" TELEPHONES.
Transmitters, Magneto Bells and Telephone Switchboards. Over 200,000 of our telephones successful operation. Used by War and Navy Departments. In ordering state length of line, whether single line or metallic circuit and number of telephones to be used on one line. Send for catalogue "S. A."
AMERICAN ELECTRIC TELEPHONE CO.,
173 South Canal St., Chicago, Ill.

Buy Telephones

THAT ARE GOOD—NOT "CHEAP THINGS."
The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are both good.
WESTERN TELEPHONE CONSTRUCTION CO.
250-254 South Clinton St., Chicago.
Largest Manufacturers of Telephones exclusively in the United States.

MAGNETO BELLS
ALL KINDS OF PARTS
ELECTRICAL SUPPLIES
SEND STAMP FOR CATALOGUE.
MIANUS ELECTRIC CO.,
MIANUS, CONN.

Valve, gas engine throttle, F. I. Hitchcock.....	625,797
Valve regulator, G. W. Lambert.....	625,171
Valves, electromagnetic mechanism for actuating engine, E. W. Taylor.....	625,792
Vapor burning apparatus, A. Kitson.....	625,175
Vat. See Tanning vat.....	
Vehicle draught attachment, T. Jones.....	625,773
Vehicle, dumping, T. Hill.....	625,765
Vehicle guard, J. M. Roach.....	625,807
Vehicles, electric device for propelling and controlling, R. M. Hunter.....	625,953
Vehicles, power transmitting mechanism for motor, C. Roe et al.....	625,808
Vending apparatus, coin controlled, A. D. Smith.....	625,812
Vending machine, F. F. Pulver.....	625,803
Ventilating device, window, J. A. Maul.....	625,891
Ventilator. See Ship's ventilator.....	
Vessel closure, A. F. Bardwell.....	626,015
Washboard, S. L. Barnollar.....	626,044
Washing machine, J. C. Smith.....	626,105
Watch, stem winding and setting, A. Anzelewitz.....	626,128
Water and steam pipe, sheet metal, F. A. Williams.....	625,946
Water bag stopper, C. E. Longden.....	626,039
Wattmeter, inspector's indicating, F. P. Cox.....	625,830
Wave motor, J. E. Hartwell.....	626,162
Weather strip, O. A. Essig.....	625,840
Weaving apparatus, Desmarais & Canal.....	626,149
Weigher, grain, C. L. Gardner.....	625,971
Weighing vessel, liquid, J. Reusing.....	625,901
Wheel. See Fifth wheel.....	
Winch, power, H. P. Hansen.....	625,974
Winding machine, G. F. Sturgess.....	625,855
Window, H. K. Doolittle.....	626,057
Wire crimping machine, J. M. Martin.....	626,183
Wire stretcher, H. C. Pratt.....	626,371
Wood holder and carrier, Hanson & Reinhold.....	625,927
Woods, producing artificial, D. Lynn.....	625,979
Wrench. See Pipe wrench.....	

DESIGNS.

Battery plate, T. T. Lewis.....	30,909
Belt, C. & E. Deitch.....	30,923
Belt, E. J. Deitch.....	30,923
Bicycle pedal rubber member, I. M. Bartlett.....	30,915
Bicycle rear fork, F. P. Burnham.....	30,914
Book cover, memorandum, P. Hufeland.....	30,873
Bottle, A. P. Blyth.....	30,877
Box, paper, R. L. Myers.....	30,871
Can, oil, S. Davis.....	30,879
Can, tea or coffee, T. F. McCormick.....	30,878
Card flat end clip, Mills & Hutton.....	30,885
Check, G. J. Bremer.....	30,872
Chimney hole cap, H. H. Ladd.....	30,905
Chin, textile, D. Howarth.....	30,927
Fan, D. A. Minard.....	30,924
Faucet body, I. Levy.....	30,893
Fence post, J. H. Boddie.....	30,913
Fence, wire, J. H. Srofe.....	30,912
Garment supporter, E. N. La Veine.....	30,918
Garment supporter, E. L. Rosenfeld.....	30,919
Gas burner, A. Strom.....	30,901
Gas burner mantle support, C. H. Frye.....	30,902
Heater, J. L. Gobeille.....	30,907
Heater attachment, W. H. Shick.....	30,906
Heel, boot or shoe, A. Sydeman.....	30,926
Hinge, E. Cox.....	30,895
Hook member, sun, J. H. Forster.....	30,897
Incubators, etc., moisture tank for, J. L. Macy.....	30,900
Knife, corn, H. S. Earle.....	30,876
Lace cover or spread, T. K. Stanley.....	30,930
Lamp fixture, G. Bohner.....	30,903
Lamp, vapor, F. G. Frankenberg.....	30,904
Lock case, H. G. Vought.....	30,875
Match safe, H. C. Chandler.....	30,881
Music staff, visible pitch, A. R. Parsons.....	30,888
Nut, split, T. L. Paine.....	30,898
Railway rail, Nichols & Taylor.....	30,910
Railway rail, E. J. Waelty.....	30,911
Rubber dam, E. H. Haskins.....	30,889
Scale lever, I. C. Koehne.....	30,886
Scrap, wire, W. O. Smith.....	30,890
Shoe, J. H. Romsey.....	30,925
Show case, J. T. Robin.....	30,889
Skirt protector, L. F. Howe.....	30,920
Spoon or fork, handle, F. H. Haskins.....	30,887
Spoons, etc., handle for, G. W. Shiebler.....	30,874
Stamp cushion, hand, J. A. Heany.....	30,884
Staple, J. La Prolle.....	30,896
Stove, E. G. Germer.....	30,908
Tool, combination, T. O. Hawlings.....	30,892
Tool handle socket, E. Malinski.....	30,891
Towel holder, etc., J. Schnarr.....	30,917
Type, font of, J. F. Cumming.....	30,916
Vaporizing vessel, J. H. Valentine.....	30,880
Warp stop motion drop, H. Wyman.....	30,899
Whip holder, L. Woodruff.....	30,882

TRADE MARKS.

Beer, C. A. Koenig & Company.....	32,976
Beer, lager, B. Schuler & Company.....	32,977
Books, Sir Isaac Pitman & Sons.....	32,964
Boots and shoes, N. Fisher & Company.....	32,970
Boots and shoes, Jordan, Marsh & Company.....	32,971
Canned fruits and vegetables, William Falt & Company.....	32,988
Chemical compound in powdered form, American Chemical Specialty Company.....	33,001
Chemical preparation for certain named purposes, Draper & Palmer.....	33,002
Cigarettes, H. L. Savory.....	32,973
Cigars, E. Seidenberg, Stiefel & Company.....	32,974
Coffee, W. S. Quinby.....	32,975
Coffee, roasted, Steinweiser & Steffen.....	32,984
Coffee, Company.....	32,985
Cotton cloth with a silk finish, Harding, Whitman & Company.....	32,989
Disinfectants and deodorizers, C. B. Blake.....	33,000
Drugs and chemicals, certain named, R. Picet.....	33,003
Embroidery, patterns, designs, and embroidery materials, Trueb & Isaacs.....	32,966
Flavoring compounds for foods, E. R. La Place.....	32,983
Food products, cereal, H-O (Hornby's Oatmeal) Company.....	32,989
Gall cure, Koselucko Gall Cure Company.....	32,994
Hames, consolidated, Hame Company.....	33,008
Horse boots, Gilliam Manufacturing Company.....	33,007
Injectors, steam, J. C. Drucklieb & Company.....	33,012
Insecticides, L. N. Adler.....	32,999
Iron articles, certain named cast, Bingham & Taylor.....	33,011
Laces, corset, Amonia & C. Company.....	32,997
Lime juice, L. Rose & Company.....	32,982
Liniment, Chisholm & Welsh.....	32,998
Liniment for certain named ailments, H. H. Hammer.....	32,997
Medicinal preparations, certain named, E. B. Turner.....	32,995
Paint, certain named, Carbolineum Wood Preserving Company.....	33,006
Paper for ticket making purposes, A. J. Smith.....	32,965
Polishing compounds, liquid, A. M. Waitt.....	33,005
Remedial agents, including cathartics and blood purifiers, G. P. Terry.....	32,993
Remedies, blood purifying, Heather Bloom Company.....	32,992
Remedy for certain named diseases, L. A. Robinson.....	32,991
Ribbons, silk, Ashley & Bailey Company.....	32,998
Salt, Wadsworth Salt Company.....	32,987
Sewing machines, J. F. Diggs.....	33,009
Sewing machines and attachments, New Home Sewing Machine Company.....	33,010
Skins, finished calf, Ayer Tanning Company.....	32,972
Smoke in furnaces, chemical compound for preventing, J. M. Wilson.....	33,004
Starch, laundry, Eagle Starch Company.....	32,990
Sirup, laxative, A. E. McBee.....	32,996
Sirup, maple, Arcadia Maple Company.....	32,996
Whisky, G. F. Heublein & Brother.....	32,979
Whisky, A. B. Sheaffer.....	32,981

LABELS.

"La Dalia" for cigars, American Lithographic Company.....	6,946
"Milo" for cigarettes and smoking tobacco, J. W. Surbrug.....	6,944
"Persperine" for toilet powder, T. W. Johnson.....	6,944

PRINTS.

"A Winner" for cigars and cigarettes, H. Traiser & Company.....	141
"Feder's Pompadour Skirt Protector," for skirt protectors, J. W. Goddard & Sons.....	143
"The Best What Gives" for beverages, J. Graf.....	142

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventor for a fee of \$10.00. The inventor may also obtain a printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

IF YOU SHOOT A RIFLE
Pistol or Shotgun, you'll make a Bull's Eye by sending three 2c. stamps for the *ideal Hand-book* "4.7" 120 pages **FREE.** The latest Encyclopedia of Arms, Powders, Shot and Bullets. Mention SCIENTIFIC AMERICAN. Address IDEAL MFG. CO., NEW HAVEN, CONN., U. S. A.

No More Rust
3 in One
OIL

Fills these requirements. An absolute preventive of rust. An ideal cleanser. A perfect lubricant. Positively will not gum. For Bicycles, Fire Arms, Typewriters, Sewing Machines and all bright (or polished) metals.
Manufactured by
G. W. COLE & CO.
139 Broadway (Room G), NEW YORK.
Send 2c. stamp for Free Sample.
Ask your dealer.

For well made, highly finished Bicycles the '99
Imperial
are unsurpassed.
Graceful and fleet, they satisfy the most critical. Our prices will interest you.
Write us.
Ames & Frost Company, Chicago.

\$5 to \$30 3000 BICYCLES
Everyone a Bargain.
NEW AND SECOND HAND.
2d Hand—good as any for service \$5 to \$12.
New '99 Models \$12.50 to \$30. None higher. We guarantee to save you money, largest variety to select from. Lowest prices ever quoted. Every customer satisfied. Shipped subject to examination and approval. No money in advance. A few good AGENTS WANTED. For price list and particulars address the old reliable cycle house.
BROWN-LEWIS CO., (F.F.) 293 Wabash Av., Chicago.

It's Easy to Mail a Dollar
and get by return post one of the handsomest Bicycle Bells ever seen. Your choice of Lion, Serpent, Turtle or Dragon.
Accurately modeled, finely hand-chased.
\$1.00 Each.
Handsome jeweled eyes. Finish, antique bronze, and patent lock clamp.
Send for Catalogue "General Cycle Sundries."
The New Departure Bell Co., Bristol Conn.

50 YEARS' EXPERIENCE
PATENTS
TRADE MARKS
DESIGNS
COPYRIGHTS & C.
Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents. Patents taken through Munn & Co. receive special notice, without charge, in the
Scientific American.
A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, \$3 a year; four months, \$1. Sold by all newsdealers.
MUNN & Co., 361 Broadway, New York
Branch Office, 625 F St., Washington, D. C.

THE ONLY CAMERA FOR ALL PURPOSES
\$5 to \$50.
FOR CATALOGUE, SEND TO
ROCHESTER OPTICAL CO.
30 SOUTH ST. ROCHESTER, N.Y.

LIQUID AIR TRIPLERS
SURPLUSAGE DEMONSTRATED, 10 Cts.
H. Gaylord Wilshire, Los Angeles, Cal. — POST PAID

LIQUID AIR TRIPLERS
SURPLUSAGE DEMONSTRATED, 10 Cts.
H. Gaylord Wilshire, Los Angeles, Cal. — POST PAID

Planning the New Home
Anyone contemplating the building of a new home will find the Building Edition of the Scientific American of peculiar and absorbing interest. This beautiful publication is issued monthly, and contains practical articles and suggestions on modern house building, together with a series of splendid plates, showing perspective views and floor plans of the most up-to-date modern dwellings, estimated cost, etc. A single issue of this handsome periodical is often worth the year's subscription price to the intending builder. Write to-day and send 25 cents for a single copy, or \$2.50 for annual subscription.
MUNN & CO., Publishers, 361 Broadway, New York.

TAUGHT BY MAIL.
ELECTRICAL ENGINEERING,
Telephony, Telegraphy, X-Rays,
MECHANICAL ENGINEERING,
Elementary Mathematics,
MECHANICAL DRAWING,
Etc. Thousands are successful and gaining better positions at salaries studying at home by our correspondence system.
The Electrical Engineer Institute of Correspondence Instruction, Dept. A, 120-122 Liberty St., New York.
I consider the Electrical Engineer Institute conducted by Messrs. Welfen and Martin to be of great value to those who desire an electrical education.
Thomas A. Edison
Write for Catalogue. State Subject You Wish to Study.

MODELS for inventors. Estab. 1867. Catalogue, J. C. SEYLA, 181 Madison St., Chicago.

ANN ARBOR MFG. CO. Ann Arbor, Mich.
Specialties to Manufacture. Correspondence Solicited.

MODELS & GEARS CATALOGUES FREE
UNION MODEL WORKS
193 CLARK CHICAGO.

ICE MACHINES, Corlies Engines, Breweries' and Bottlers' Machinery. T. B. WILDER
MFG. CO., 899 Clinton Street, Milwaukee, Wis.

ACETYLENE DEALERS' HAND BOOK
Information net. 42 pp. 10 cts.
F. CORTEZ WILSON & Co., Chicago.

STEEL STAMPS FOR MARKING TOOLS & C
FIGURE & ALPHABET SETS AT LOWEST PRICES.
BEST STEEL.
SEND FOR CIRCULAR.
SCHWAB STAMP & SEAL CO.
MILWAUKEE WIS.

Experimental & Model Work
Dir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N. Y.

STEEL ROLLERS, ROLLING MILLS
TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY
NOVELTIES & ETC. NEW YORK STENCH, WORKS 100 NASSAU ST. N.Y.

TURBINES Send for Circular "M."
JAS. LEFFEL & CO.
Springfield, Ohio, U. S. A.

GAS AND GASOLINE ENGINES
WATER MOTORS
BACKUS WATER MOTOR CO. NEWARK N.J. U. S. A.

FOR SALE.—Canadian patent No. 61,119 (1898), English patent No. 27,368 (1898), and French patent on same invention. Address, L. M. Campau, 94 Fort St., W., Detroit, Mich.

GRINDING MILLS FOR ALL PURPOSES.
Bogardus Patent Universal Eccentric Mill. Address J. S. & G. F. SIMPSON, 28 Rodney Street, Brooklyn, N. Y.

NOVELTIES & PATENTED ARTICLES
Manufactured by Contract. Punching Dies, Special Machinery. E. Konigslow & Bro., 181 Seneca St., Cleveland, O.

YOU CAN MAKE \$100 A WEEK!
OWN YOUR OWN SHOW, COMPLETE OUTFIT—\$100.
LIFE MOTION FILMS & MACHINES.
GREAT PASSION PLAY & 500 OTHER SUBJECTS
S. LUBIN, LARGEST MFR. PHILADELPHIA P. A.

BUILDERS AND DESIGNERS
SPECIAL MACHINERY
C. H. Cowdrey Machine Works,
5 Main St., Fitchburg, Mass.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches & Elevators
PROVIDENCE R. I.

WE WANT YOU to send us your name and like to send **EVERY GOOD FARMER**
A FREE SAMPLE COPY OF THE
Agricultural Epitomist
For the busy, practical working farmers of America. It is their paper and claims their support. Don't fail to write us at Once Giving Address: Postal Will Do.
AGRICULTURAL EPITOMIST, Indianapolis.

114,230 NOW IN USE.
Big Service. Little Cost.
Its convenient Hot Water Supply, so necessary to any bath and that it may be used in a bath or any other room to equal advantage in connection with water service or independently is what is making the "Mosely" famous. Complete, with heater, \$25.50 up. Delivered east of Rocky Mountains. Monthly payments if wanted. Send for catalogue
MOSLEY FOLDING BATH TUB CO.
358 "K" Dearborn St. CHICAGO.

Planning the New Home
Anyone contemplating the building of a new home will find the Building Edition of the Scientific American of peculiar and absorbing interest. This beautiful publication is issued monthly, and contains practical articles and suggestions on modern house building, together with a series of splendid plates, showing perspective views and floor plans of the most up-to-date modern dwellings, estimated cost, etc. A single issue of this handsome periodical is often worth the year's subscription price to the intending builder. Write to-day and send 25 cents for a single copy, or \$2.50 for annual subscription.
MUNN & CO., Publishers, 361 Broadway, New York.

Fauber Hangers.

The Genuine **ONE PIECE** are used on the BEST Bicycles, Tandems, Tripletts and Quads.

FAUBER, Originator, Pioneer, Largest Manufacturer One Piece Hangers.

YOU!

With mechanical ability and judgment appreciate the Simple and Practical construction of the Fauber. The Cranks and Axle are made of One Piece of Steel, spring tempered, no joints to work loose, used so extensively you can get any needed repairs in any part of the United States.

Beware of Infringements (Cheap Imitations).

W. H. FAUBER, Mfr., Chicago, U. S. A.

SEE Trade Marks on Cranks and Sprockets.

THOROUGH INSPECTIONS

HARTFORD STEAM BOILER

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY STEAM-BOILER EXPLOSIONS

J. M. ALLEN, PRESIDENT V. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY F. B. ALLEN, 2ND VICE PRESIDENT
L. B. BRAINERD, ASST. TREAS. L. F. MIDDLEBROOK, ASST. SECY.

100 miles for 50 cents



Price \$1,000. No Agents.

The first cost practically ends the expense. Hydro-carbon Motor, one-half cent a mile running cost. Everything about it built for durability and comfort.

Write for Catalogue and date of delivery.

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.

HOW TO MAKE AN ELECTRICAL

Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or by any bookseller or newsdealer.

Swiftest, Strongest

Saves Most and Lasts Longest

Remington

Standard Typewriter

WYKOFF, SEAMANS & BENEDICT, 327 Broadway, New York.

There is no Kodak but the Eastman Kodak.

By the

KODAK SYSTEM

of film photography the instrument loads and unloads in broad daylight.

The film is put up in cartridge form and is perfectly protected from light by a strip of black paper extending the full length of the film and several inches beyond each end.

To load: simply insert this cartridge in the Kodak; thread up the black paper; close the camera and give the key a few turns, thus bringing the film into position.

The picture taking may then begin. The roll of a dozen exposures being completed the black paper covers all, and the cartridge can be removed as easily as it was inserted.

Film Cartridges weigh ounces where plates weigh pounds and are non-breakable. All Kodaks use light-proof film cartridges and load in daylight.

Kodaks \$5.00 to \$35.00.

Catalogues free at the dealers or by mail.

EASTMAN KODAK CO. Rochester, N. Y.

JESSOP'S

Best Crucible Tool Steel.

CAUTION!

The above is a facsimile of tags attached to a large shipment of Steel, neither made nor sold by us, which was delivered to a manufacturer in Massachusetts, and was used for deceptive purposes. Genuine Jessop's Tool Steel is stamped and labeled.

W. JESSOP & SONS' CAST STEEL WARRANTED, and no tag like the above is ever used by us. Buyers are warned against this fraudulent product and are kindly requested to furnish us with information to enable prosecution of the offenders, if any who read this notice have knowledge of similar deception.

WM. JESSOP & SONS, Ltd., 91 John Street, New York.

"PEGAMOID"

TRADE MARK

ALUMINUM PAINT.

Latest application of Aluminum. Looks like Frosted Silver. Washable. Untarnishable. Water, Oil and Weatherproof. Durable. Easily Applied. Bicycles, Yachts, Radiators, Pipes, Metal Work, Machinery, Dynamos, Motors, Apparatus, Arc Lamps, Sockets, Brackets, Cars, Stations, General Decoration, etc. Sample bottle, by mail, for 25 cents.

THE AMERICAN PEGAMOID CO., 346 B'way, New York.

CHARTER Gasoline Engine

USED ANY PLACE FOR ANY PURPOSE

Stationaries, Portables, Engines and Pumps.

State your Power Needs.

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

CRESCENT BICYCLES

Adults' Chain Models, \$35

Bevel Gear Chainless Models, \$60

WESTERN WHEEL WORKS, MAKERS, CHICAGO. NEW YORK.

Burst Water Pipes a Thing of the Past

You can now make all water pipes as secure from bursting in winter as in summer. This pneumatic system is the only one which successfully prevents the annoying and costly bursting of water pipes. It has solved a great economic problem. Highly endorsed by Architects, Engineers and Municipal Officials. No new house should be completed without this system, and all house owners should avail themselves of this "ounce of prevention" in season.

Send for Illustrated Booklet, giving full explanation and discount.

THE PNEUMATIC DOME MANUFACTURING COMPANY, 501 E Street, Northwest, Washington, D. C.

TANKS

(Louisiana Red Gulf Cypress a Specialty.) Best known for every purpose. Good material. Correct Workmanship. Low Prices. Get our Illustrated Catalogue. W. R. Caldwell Co., 223 E. Main St., Louisville, Ky.

PARALLEL CHESLEY & CO. CLAMPS ALL SIDES U.S.A.

WE have yet to hear of a rider of the COLUMBIA BEVEL-GEAR CHAINLESS who would willingly give it up for any other wheel.

Direct testimony is always better than heresay evidence. If you desire to know about Bevel-Gear Chainless Bicycles, do not ask a person who has never ridden one, or is in any way connected with a manufacturer who does not make them. Inquire of riders of the Columbia Bevel-Gear Chainless. There are thousands of them throughout the country. They are to be met in every city, in almost every town of the United States—so popular has the machine become in the short space of a year and a half. There are reasons for this. The chainless is easier to take care of than the chain wheel. It has a longer life. Every ounce of power applied to the pedal is made effective. This last advantage over chain-driven wheels is apparent the moment you mount the machine. The Chainless seems to possess an activity and life of its own. You notice it in starting, stopping, back-pedaling, riding on levels and especially in ascending grades.

COLUMBIA CHAINLESS BICYCLES, \$60 to \$75.

Chain Wheels, Columbias, Hartfords and Vedettes, \$25 to \$50.

POPE MANUFACTURING CO., HARTFORD, CONN.

LATHES Foot Power, High Grade

W. P. Davis Mach. Co., Rochester, N. Y.

Tribune Bicycles

for 1899.

The Best Wheels in the World.

Write for large New Catalogue illustrating our full line of twenty-three models.

The Black Mfg. Co., Erie, Pa.

Thor

No Bicycle is perfect without **"THOR" FITTINGS**

hubs, crank hangers, seat post expanders and handle bar expanders. The "Thor" crank hanger consists of patented two piece crank possessing the advantages of perfect simplicity, rigidity and security, removable at will without disturbing bearing parts or adjustment; the whole making the neatest, simplest and most perfect mechanism of a crank hanger ever produced. Any bicycle maker will put them on the wheel you order if you insist upon having them. See that the trade mark "THOR" is on Cranks, Hubs and Expanders. Write for Catalogue.

AURORA AUTOMATIC MACHINERY CO., Aurora, Ill.

DON'T LEAVE YOUR KEYS

in the front door. Fasten them to the pocket or waist-band with a key chain secured by the Improved Washburne Patent Fastener. Slips on easily, grips like grim death, don't tear the fabric, released instantly. By mail, 25 cents. Catalogue of other novelties, free.

AMERICAN RING CO., Box P, Waterbury, Conn.

PRESSES, DIES and Special Machinery

For Sheet Metal Workers.

West Mfg. Co., Buffalo, N. Y., U.S.A.

"PERFECTION" AIR MATTRESS

FOR SPORTSMEN

hunting, fishing, camping or yachting. May be laid on ground or deck insuring a comfortable bed, free from dampness. When deflated, rolls small and can be packed in grip. Weight 10 to 15 lbs., according to size.

These mattresses afford great comfort to invalids and bedridden patients. Largely used by U. S. Government and by sportsmen throughout the world. Catalogue free.

MECHANICAL FABRIC CO., PROVIDENCE, R. I.

PROTECT YOUR FAMILY

A sense of security pervades the home which shelters a

SMITH & WESSON Revolver.

SMITH & WESSON, 14 Stockbridge Street, Springfield, Mass. Catalogue for a stamp.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS, ETC.

WM. JESSOP & SONS LTD 91 JOHN ST. NEW YORK

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York